**University of Alberta**

# Evaluation of ST elevation myocardial infarction (STEMI) patient care stakeholders' perceptions on paramedic-based pre-hospital management of STEMI

by

©

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*"A Physician can sometimes parry the scythe of death, but has no power over the sand in the hourglass."* - HL Piozzi (1781)

## Abstract

The overall objective of this study was to identify factors influencing implementation of a paramedic-based Pre-hospital management of ST elevation myocardial infarction (PHM of STEMI) patient program by evaluating the views of paramedics, cardiologists, emergency physicians and emergency nurses, through focus group and survey methodologies.

A total of eighteen representatives from each group attended respective focus group meetings and identified barriers and facilitators to PHM. Barriers include: technological failure, lack of communication between paramedics and hospital staff. Facilitators include: hospital staff understanding paramedics' field experience and stakeholders' regular maintenance of PHM knowledge.

Emergent views from the focus groups provided content for a subsequent 25 item-survey which was administered to 619 stakeholders. The response rate was 57.3%, and a majority supported a PHM program with physician overview. Surveys confirmed most views from the focus groups. Addressing identified barriers can improve existing programs and enhance implementation of new ones across North America.

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# Chapter 1

# Introduction

## 1.1.0 Myocardial Infarction and Treatment Approaches

### 1.1.1 Epidemiology of Myocardial Infarction

Coronary artery disease is the leading cause of mortality and morbidity internationally.[1,2] In Canada alone, acute myocardial infarctions (MI) account for approximately 19% of all deaths.[3] In the United States, MI occurs in approximately 896,000 individuals per year with an associated average of 15 years of life lost.[4] Furthermore, MIs are common antecedents of other cardiovascular conditions such as heart failure, dysrhythmia and sudden cardiac death.[1]

### 1.1.2 Pathophysiology of Myocardial Infarction

MIs are caused by a sudden attenuation of coronary artery blood flow as a result of atherosclerosis and concomitant thrombosis (with or without vasoconstriction). Myocardial infarction can be divided into two groups: ST elevation MI (STEMI) and Non ST elevation MI (non STEMI).[5] In STEMI specifically, rupture of an inflamed lipid-rich plaque along the coronary arterial wall, and the subsequent release of procoagulant factors induces platelets to bind to fibrinogen, leading to a persisting clot formation (thrombus) in the lumen which results in occlusion.[5,6] Although non STEMI and STEMI share similar pathophysiologic mechanisms, their treatment and urgency of management is different.[1] This thesis focuses on strategies for early STEMI treatment.

### 1.1.3 Definition of Myocardial Infarction

Although it is widely accepted that MI reflects the death of cardiac myocytes caused by prolonged ischemia (i.e., imbalance of blood supply and oxygen delivery, and demand for adequate oxygenation of the organ), it can be defined from various perspectives related to clinical, electrocardiographic (ECG), and biochemical characteristics.[7] The World Health Organization definition of MI, which is commonly adopted, requires the presence of two of the perspectives described below:[8]

Clinical perspective: Symptoms of myocardial ischemia/infarction can include discomfort located in the chest, epigastric area, arm, wrist or jaw with exertion or at rest. Associated symptoms that must also be considered include: dyspnea (shortness of breath), nausea, vomiting and diaphoresis, or any combination of these symptoms.

Electrocardiograph (ECG): In patients with STEMI, the ECG may show ST-segment elevation indicating ischemia, as well changes in the QRS such as left bundle branch block.

Biomarkers: MI can be recognized when the level of different proteins are released into the blood due to necrosis of cardiac myocytes. These biomarker proteins include cardiac troponins T or I, which have high myocardial tissue specificity and high sensitivity, and the MB fraction of creatine kinase (CK-MB) which is less tissue-specific than cardiac troponin but its clinical specificity for irreversible injury is more robust. Although these biomarkers reflect myocardial infarction, they do not indicate its mechanism.[7,8]

### 1.1.4 Reperfusion Strategies

The advent of angiography in the 1980s confirmed that MI was caused by coronary artery thrombosis, and spawned reperfusion strategies that led to subsequent studies of clot lysis by fibrinolytic agents.[6] Additionally, the ability to visualize blood flow along the coronary arteries, allowed a balloon catheter (percutaneous coronary intervention or PCI ) to be used as a mechanical means of establishing coronary reperfusion (termed primary PCI in the setting of MI).[9] These competitive reperfusion strategies (i.e., fibrinolytics and primary PCI), sparked ardent debates over which of the two methods provides the maximum benefit for the management of patients with STEMI.

#### 1.1.4.a Primary Percutaneous Coronary Intervention (PCI) Reperfusion Strategy

An earlier multi-centre randomized study (DANAMI-2) demonstrated that patients treated with primary PCI had significantly lower rates of the composite endpoint of death, reinfarction and disabling stroke.[10,11] Other randomized clinical trials comparing timely PCI in experienced centres with fibrinolytic therapy have demonstrated higher patency rates, lower early reocclusion rates, better residual left ventricular function, and overall better clinical outcomes.[12-17] However, achieving timely primary PCI treatment remains a challenge and if PCI is significantly delayed, its benefit over fibrinolysis is lost.[2,18]

#### 1.1.4.b. Fibrinolytic Reperfusion Strategy

Studies of fibrinolysis for STEMI have shown that *time-to-treatment* is a salient moderator of reperfusion success and benefit of treatment. Boersma *et al.*, in their analysis of 22 trials of 58,600 patients on fibrinolytic therapy, found that the absolute mortality reduction per 1000 patients decreases by nearly 50% when treatment is delayed

from the first hour to the second hour after symptom onset.[19] Similarly, the Fibrinolytic Therapy Trialists' (FTT) demonstrated that among the 45,000 patients presenting with STEMI or bundle-branch block, there was an absolute mortality reduction of about 30 per 1000 for those treated within 6 hours of symptom onset compared to 20 per 1000 presenting 7-12 hours from onset.[20]

Such evidence of the benefits of early treatment has re-focused interest in taking fibrinolysis to the patient (pre-hospital fibrinolysis, PHF) to reduce these delays. The potential benefits of providing cardiac care (e.g., resuscitation of patients with cardiac arrest due to MI) in the field by deploying physician-staffed ambulances, was described as early as 1967. This study reported zero incidence of patient-death during transportation to the hospital for patients receiving cardiac care in the field (0/300), compared to those who had not been exposed to the system (102/414).[21] This set the stage for employing physician-led ambulance teams to administer intravenous fibrinolysis, with a demonstrated significant improvement in patient outcomes.[22] In this paper, we have used the term pre-hospital management of STEMI patients (PHM) to describe the steps of STEMI patient identification through assessment, ECG acquisition, triage and treatment by fibrinolysis, while en-route to the hospital.

Of the 6 major randomized trials comparing PHM to in-hospital fibrinolysis, [23-28] only one showed a significant reduction in mortality.[28] However, a meta analysis of the six trials demonstrated a 58 minute reduction in time-to-treatment with PHM, with an associated 17% relative risk reduction and 1.7% absolute risk reduction in mortality ($P<0.05$).[29] Further benefit of early treatment with pre-hospital fibrinolysis was demonstrated in a study that compared PHM to primary PCI.[13] The results showed a

trend towards reduced mortality in favour of PHM. However, in an analysis of patients randomized within 2 hours of symptom onset, there was a significant advantage of PHF on mortality reduction over primary PCI.[30] Bjorklund and colleagues compared PHF and in-hospital fibrinolysis in a prospective cohort, demonstrating a 1 hour reduction in time-to-treatment with an associated reduction of 1-year mortality by 30% in favour of PHM consistent with randomized trial results above.[31]

More recently, a holistic look at the accumulation of data from research regarding both PCI and fibrinolysis has shifted the view from a single reperfusion approach, to a dynamic approach utilizing the most appropriate mode of reperfusion for the individual patient. Primary PCI (PCI only, with no prior fibrinolysis) is the preferred treatment if it can be performed by an experienced team within 90 minutes after first medical contact with a STEMI patient.[1] It is also preferred for patients in cardiogenic shock and those who have contraindications to fibrinolytic therapy, or after failed fibrinolysis in patients with large MI. On the other hand, fibrinolytic treatment is preferred in the absence of contraindications,[1] if primary PCI cannot be performed within 90 minutes after first medical contact, and if patients are presenting less than 3 hours after symptom onset.[1] The ACC/AHA guidelines have detailed recommendations on the use of reperfusion therapy.[1]

### 1.1.5 Barriers to Pre-hospital Management of STEMI Patients Implementation

Despite the evidence favouring the benefits of pre-hospital fibrinolysis, implementation of such programs has been almost exclusive to Europe. One possible explanation for this discrepancy is that the majority of ambulances in Europe are staffed by physicians. For example, in five of the six randomized trials comparing PHM to in-

hospital fibrinolysis, the fibrinolytic provider in the mobile intensive care unit (PHM) was a physician.[29] This concept is not feasible in North America as there is a lack of physician presence in the pre-hospital setting.[32,33] However, administration of therapy to the patient in the pre-hospital setting can be achieved by paramedics.

The earliest use of a paramedic-initiated PHM was reported in New York City in 1988, where paramedics administered streptokinase (fibrinolysis) after symptom onset following approval from a remote physician. In this case, the patient's ECG returned to normal the next day, followed by a normal left-ventricular wall motion and a 70% ejection fraction ten days later.[34] Almost two years later, the first reported pilot study of paramedic-based PHM demonstrated that the patients in the field received therapy an average of 86 minutes earlier than those treated in the emergency department (133 minutes vs. 47 minutes; $p=0.00005$).[35]

Several more recent paramedic-based PHM studies have demonstrated that the time between symptom onset and therapy was reduced by approximately 1 hour, with favourable outcomes, for the PHM approach compared to other strategies.[28,31,36] Furthermore, in the ASSENT-3 Plus trial, the median time to fibrinolysis was 12 minutes longer in study sites with physician-staffed versus paramedic-only staffed ambulances.[37]

These paramedic-based PHM programs are in line with the ACC/AHA guidelines[1] that recommend establishing a pre-hospital fibrinolysis program in a setting where physicians are present in the ambulance, or in an EMS system with full-time paramedics capable of providing therapy with an online medical command, and an established medical director with STEMI management experience.[1]

In the paramedic-based model of PHM (Vital Heart Response or VHR) that is adopted within the Edmonton region, paramedics are trained to complete a checklist for symptoms, and obtain and interpret 12-lead ECGs in patients with suspected MI. The ECG readings are sent to a physician manning the response line on a Personal Digital Assistant (PDA). The physician then evaluates the ECG and checklist over the phone with the paramedics and decides whether or not a patient is eligible for fibrinolytic treatment (initiated by paramedics). This regional PHM program is safe, reduces time to treatment, and improves patient outcomes.[38]

Despite reasonable evidence that a paramedic-based PHM program is feasible and effective in treating STEMI patients, these services are still not widely available in North America. Furthermore, PHM delivery within the region still remains sub-optimal. For example, the median EMS arrival to fibrinolysis time reported at 41 minutes, despite stringent research trial requirements, falls approximately 10 minutes short of the ACC/AHA recommended time. Moreover, only 46% of the patients eligible for fibrinolysis received the therapy, identifying a significant care gap.[36] To address these issues, barriers and facilitators to PHM need to be identified. Insights on barriers and facilitators can be drawn from paramedics and hospital staff in direct care of STEMI patients as the success of PHM programs' implementation and ability to reduce-time-to treatment depends largely on the coordinated efforts of these groups. Currently the views of stakeholders regarding barriers and facilitators to PHM implementation in North America have not been captured.

## 1.2.0 Purpose and Objectives

The general purpose of this thesis was to expand our understanding of stakeholders (cardiologists, paramedics, emergency physicians and emergency nurses) perceptions of the Edmonton program for PHM of STEMI. The specific objectives were to:

1. Identify barriers and facilitators to PHM, through stakeholder focus group sessions.
2. Develop a survey instrument to provide external validity of focus group-derived perceptions within the broader stakeholders' population.

### 1.2.1 Significance

Approximately one third of patients with STEMI die within 24 hours of the onset of ischemia, and many of the survivors suffer significant morbidity, including heart failure and stroke.[39,40] Consequently, the resulting need for hospitalization and post MI care can impose a burden on healthcare systems across the world and the economy.[40,41] This burden can be reflected by observing 2006 statistics from the US. More specifically, the total cost for physicians and other professionals in care of this population, hospitalization and nursing-homes, medication, and home healthcare, relating to coronary artery disease patients was estimated at $75.2 billion.[40] Additional costs due to losses in economic productivity were estimated to be $142.5 billion. However, management incorporating risk-stratification and early reperfusion can mitigate coronary artery disease related mortality and morbidity and their associated costs.[42,43]

Pre-hospital management of STEMI patients can enhance early reperfusion, reduce mortality and morbidity, and improve quality of life.[29,44] However, poor

implementation of PHM programs in North America arrest the ability of healthcare regions to fully achieve the potential benefits of this strategy.

To help promote PHM implementation, there is a need to identify underlying barriers and facilitators. As previously discussed, clinical trials provide compelling evidence in support of PHM programs; however, they inadequately identify factors influencing PHM implementation. Key sources of insight on issues surrounding PHM can be obtained from stakeholders exposed to a PHM program and/or providing direct care to the STEMI patients. Their reflected experiences (focus group sessions) with the program from its onset to its current status can bring forth a multitude of unexplored issues which can be confirmed through quantitative methods (survey), and addressed through educational programs and changes in policy. By addressing barriers and enhancing facilitators to PHM program implementation, we can improve existing PHM programs and begin the process to implement new ones.

## 1.3.0 General Methods

Qualitative research methods, including focus group methodology, provide unique insight into underlying barriers, otherwise not possible with a quantitative approach.[45,46,47] Notwithstanding, quantification of the identified issues could improve external validity prior to widespread change of existing programs. Therefore, we employed both focus groups (qualitative) and a questionnaire (quantitative) based on emerging content from the qualitative research to capture views of stakeholders within the region.

### 1.3.1 Qualitative Research

Whereas quantitative research strives to demonstrate causality or associations between variables and make predictions through numerical information and statistical findings, qualitative research aims to generate meaning or identify patterns for the purpose of providing description and enhancing understanding of issues.[48,49,50] Qualitative inquiry is based on the concept that human behaviour is always bound to the context in which it occurs (e.g., social, cultural and institutional settings), and it is important to portray the meaning that is constructed by the participants involved.[48,49]

There are three main features that distinguish qualitative methods from quantitative methods of research.[51] Firstly, qualitative inquiry seeks to understand human interactions in their social context by eliciting experiences, meanings and perspectives from the participants' point of view, the "emic" perspective, as opposed to the researcher's point of view or "etic" perspective. Secondly, qualitative research takes into account the underlying values and context integral to a phenomenon.[49,50] Lastly, qualitative research relies on an inductive reasoning processes to interpret and structure constructs and meanings derived from the data. This means that qualitative research uses the data reflecting a phenomenon to create a hypothesis or theory about the phenomenon. This is contrary to quantitative studies which follow deductive reasoning, which begins with a theory or hypothesis, and the data are used to confirm or refute an existing theory or hypothesis.[48,50]

### 1.3.2 Approaches of Qualitative Research

There are various types of approaches to qualitative research, which differ in terms of the type of research question they undertake, the analytic strategy and in some

cases style of presentation.[50,51] The common approaches are grounded theory phenomenology, ethnography, and narrative analysis. The phenomenological approach aims to understand how an individual experiences an event or phenomenon, and the meaning attached to the phenomenon.[49,50] Ethnographic research involves interpreting the processes of cultural behavior such as beliefs and relationships, through interviews and observation.[49,50] Narrative studies provide accounts of people's life experiences and/or explanations of how individuals respond to their experiences.[49,50]

Grounded theory focuses on describing the psychological and social processes that people use to help them make sense of their world. As a result, individuals' perspectives on a given phenomenon within a specific context are uncovered. Data for grounded theory are analyzed using the "constant comparative" method of analysis. This highly systematic strategy involves data (statements, theme) collection, analysis, and comparison for similarities and differences [49, 50, 51,52] between data. This process is thoroughly described in Chapter 2. The findings can be used to develop interventions that may have predictable results.[48,53] We have selected the grounded theory approach as it is suitable for our study objectives.

### 1.3.3 Strengths and Limitations of Qualitative Research

All qualitative research studies are generally recognized as having the following limitations and strengths.[48]

1.3.3.a Limitations

Qualitative studies are generally time-consuming. In addition, they are not as generalizable as quantitative studies because of their inherent subjective and context-dependent nature.

1.3.3.b Strengths

Data generated from qualitative studies are in-depth and detailed. Additionally, findings can be used to generate subsequent qualitative and quantitative studies.[54] Moreover, since they consider contextual variables, the data are considered to have a strong internal validity.[48] Qualitative research makes a prominent contribution in areas where little research has been conducted, and hypothesis or theory testing cannot be carried out because variables relating to the concept of interest have not been identified.[55]

**1.3.4 Types of Data Gathering Methods**

The most common types of data collection methods used in qualitative research are interviews, focus groups, and document analysis and observation.[49] Of these approaches, focus groups are commonly used to gather data on an individual's perceptions, beliefs, and feeling about a phenomenon, by facilitating interaction and sharing of opinions between participants. This qualitative method has several advantages such as the ability to gather a wider spectrum of perspectives on an issue in a short period of time.[56] In addition, comments by one individual can stimulate other participants' to share their thoughts and opinions. This "cueing phenomenon" may help the researcher extract deeper understanding of underlying issues, otherwise not possible in other qualitative methods. Focus groups can also function in generating survey questions and formatting questionnaires as review of sessional transcripts can reveal vocabulary and new information which may be useful in the wording and content of survey instruments.[48, 57] Focus groups; however, also carry some limitations. For example, participants may feel compelled to give socially acceptable responses (social desirability bias) in the presence of a moderator. Another limitation is the possibility of an

interviewer bias, where the interviewer's (moderator) personal qualities (e.g. gender) and values affects way questions are asked or responses are interpreted.[49]

### 1.3.5 Questionnaire-Surveys

Questionnaires are frequently used to collect data as they allow the researcher to gather information from a large sample of people relatively quickly and inexpensively.[58,59] Questionnaires can gather information about knowledge, perceptions, and behaviour; otherwise not possible to obtain from other methods of research. A disadvantage of administering surveys is that they are prone to low response rates.[48]

It is generally recommended to use an existing questionnaire whenever possible; however, a current questionnaire regarding perceptions of the four stakeholder groups on PHM, within a region that has an established PHM program did not exist. As such, it was necessary to construct a new questionnaire. The advantages of constructing a new questionnaire are: questions can be designed to fit the framework of the study, and extraneous items can be avoided. As a result, a questionnaire can be tailored to meet the researchers' objectives.[60] A general advantage of a mailed questionnaire is, unlike a face-to-face discussion, it offers anonymity or confidentiality to the respondent, thereby increasing the chances of eliciting more truthful or accurate responses. A disadvantage is that responders may misinterpret the wordings in the question stems.[49] Evidently, the use of qualitative methods to generate items for the questionnaire can minimize the possibility of misinterpretation by using words familiar to the target group, while ensuring that the issues are placed in an appropriate context.

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# Chapter 2

## Focus Group Methodology to Evaluate the Attitudes and Perceptions of Paramedics, Cardiologists, Emergency Nurses and Physicians Regarding Pre-hospital Diagnosis, Triage and Treatment of STEMI Patients.

### 2.1.0 Introduction

In 2001, acute myocardial infarction accounted for 19% of deaths in Canada and coronary artery disease is the leading cause of death internationally.[1] Since timely reperfusion is paramount in salvaging viable myocardial cells and improving clinical outcomes, the ACC/AHA and Canadian guidelines emphasize establishing systematic approaches to abate treatment delay.[2-6] Advanced pre-hospital management (PHM) including administration of pre-hospital fibrinolysis (PHF) upon first medical contact in the field, is feasible[7] and has been demonstrated to improve clinical outcomes through reduction in treatment delay.[8] Many European health care regions have adopted PHM as standard of care,[9] while North America remains virtually devoid of this treatment approach. This distinction can be explained, in part, by the ability of European healthcare systems to staff physicians in the pre-hospital setting, whereas, the healthcare system in North America depends on paramedics to provide pre-hospital care. The WEST study,[10] also echoed by a previous study,[11] demonstrated that paramedical-based PHM is safe and effective within our healthcare system. Based on these findings, PHM has been implemented in the Edmonton region as 'standard of care'.

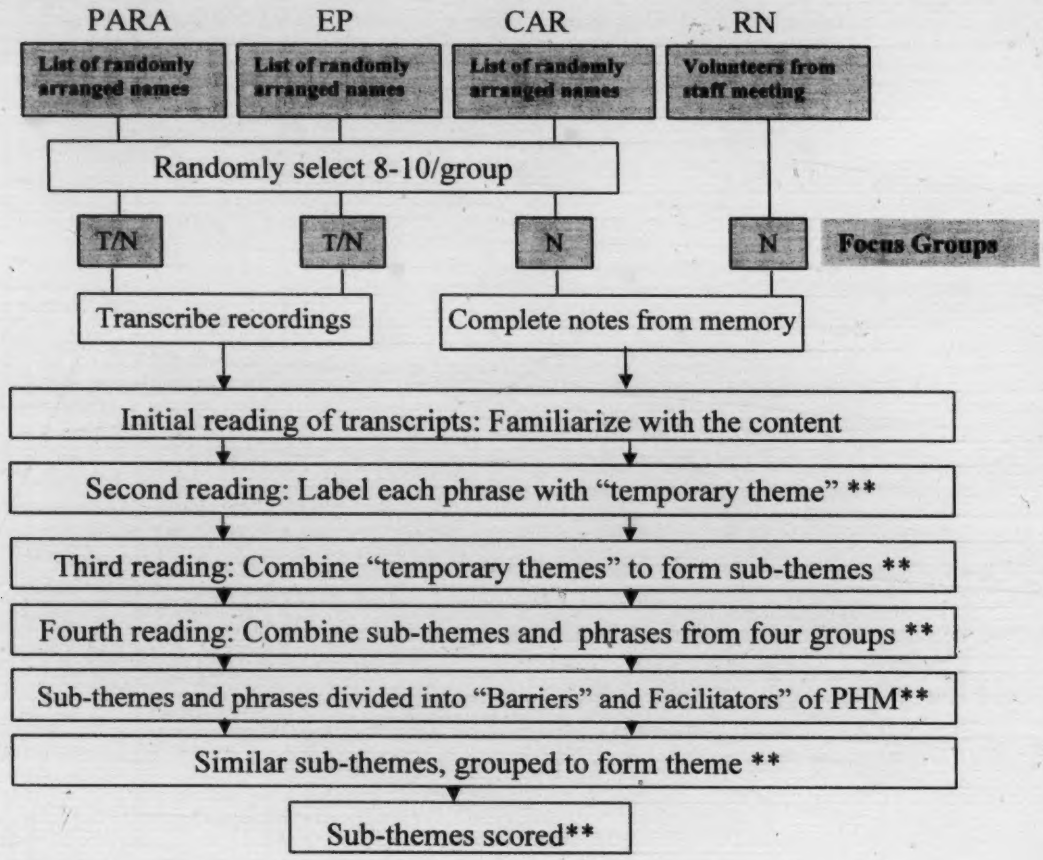
There is limited information regarding barriers towards PHF at the systems level and paramedics' attitudes towards this treatment approach.[12,13,14] Indeed, there is little known about opinions towards PHM across the health care team involved in care of

STEMI patients including: cardiologists, emergency department physicians and nurses. Thus, capturing the perceptions and attitudes of stakeholder groups may provide a holistic perspective on underlying barriers. Moreover, establishing a unified understanding of PHM, and commitment to an integrative approach to care may enhance the program's success. Accordingly, we explored paramedics', cardiologists', and emergency department physicians' and nurses' perceptions, attitudes and knowledge of pre-hospital care of acute STEMI patients using qualitative methods.

## 2.2.0 Methods

We used standard focus group methodology because of its high internal validity, speed of completion and flexibility to explore unanticipated issues.[15,16] A summary of methods described below is provided in Figure 2-1. The University of Alberta's Human Research Ethics Board provided ethical approval for this study.

Figure 2-1: Focus Group Procedure from Recruitment of Participants to Analysis of Data.


PARA
EP
CAR
RN
List of randomly arranged names
List of randomly arranged names
List of randomly arranged names
Volunteers from staff meeting
Randomly select 8-10/group
T/N
T/N
N
N
Focus Groups
Transcribe recordings
Complete notes from memory
Initial reading of transcripts: Familiarize with the content
Second reading: Label each phrase with "temporary theme" **
Third reading: Combine "temporary themes" to form sub-themes **
Fourth reading: Combine sub-themes and phrases from four groups **
Sub-themes and phrases divided into "Barriers" and Facilitators" of PHM**
Similar sub-themes, grouped to form theme **
Sub-themes scored**

PARA: Paramedics, EP: Emergency Physicians, CARD: Cardiologists, RN: Emergency Nurses
T = tape-recorded; N = notes
Emergency room nurses were recruited after a scheduled nurses' staff meeting
Tape-recording failure for Cardiology Group
** Reviewed by two reviewers to ensure consistency of content and analysis

### 2.2.1 Setting and participant sampling

This study was conducted within the Edmonton metropolitan area with an estimated population of 1,014,000. There are 2 tertiary care hospitals with cardiac catheterization laboratories and percutaneous coronary intervention and 4 community hospitals with fully equipped coronary care units (CCU). There are six (Edmonton, Leduc, Parkland, St. Albert, Strathcona, and Wetaskiwin) participating ambulance authorities brining STEMI patients to these hospitals.

Although there are no set guidelines for size of group, five to ten participants are generally recommended[17,18,19] to allow all members to contribute to the discussion and present a full range of views. Larger groups are more conducive for participants to become passive and refrain from contributing.[15] Participants in large groups may form smaller groups, making side conversations that may be relevant to the discussion but unintelligible or disruptive. Small groups run the risk of becoming stagnant, if participants are not interested in the research topic.[15] Moderators can overcome these circumstances by adjusting their level of involvement.[17]

Accepting the potential for volunteer dropout, we planned to acquire eight to ten participants for each focus group session. We obtained inclusive lists of groups of interest (Paramedics, Cardiologists, and Emergency Physicians) from Edmonton and surrounding regions. From these lists, 24 potential subjects were randomly selected in numerical sequence. They were contacted and invited to participate in the focus group session sequentially until eight to ten agreed to participate. Emergency room nurses were recruited after a scheduled nurses' staff meeting.

The focus group sessions were scheduled be 1 to 2 hours in duration to leave ample time for discussion and to be considerate of participants' time. Four focus group sessions, one per each group, were conducted to maximize the range of emergent issues relating to PHM.[20,21]

### 2.2.2 Focus Group Session

During each of the focus group sessions, the participants' opinions and beliefs regarding advantages and disadvantages as well as facilitators and barriers to PHM were explored using a funneling technique. A question map was used to ensure that the groups covered a list of predefined issues (Figure 2-2).[18]

Figure 2-2: Funneling Technique for Focus Group Discussions.

**Introductory question**

- *"Tell us something about yourself and what you enjoy about your career?"*

**General questions regarding PHM**

- *"What do you think are the advantages and benefits of pre hospital management of STEMI?"*
- *"What do you think are the disadvantages or risks of PHM?"*
- *"What factors facilitate PHM?"*
- *"What factors act as barriers to PHM?"*
- *"Any differences in these views regarding PHM in rural versus urban regions?"*

**Specific questions regarding PHM**

- *"How would you describe the paramedics' capability of identifying STEMI?"*
- *"How would you describe the paramedics' capability of placing 12 leads and IV's"*
- *"What are your views on obtaining a signed Informed Consent from a STEMI patient?"*
- *"Who should be the VHR* Physician or the physician responsible for manning the response line?"*
- *"How often would paramedics need to deal with STEMI patients to maintain competency of PHM protocol?"*
- *"Can paramedics provide PHM without physician overview?"*

**Final question**

- *"Is there anything that you'd like to say, that we haven't gone over, or that you would like to further elaborate on?"*

* VHR = Vital Heart Response is the established PHM Program in Edmonton

The introductory question was used to allow participants to get to know one another and the common features they share. Subsequent questions were related to the PHM program, and started off as general questions to more specific questions examining steps in the PHM process. Investigators chose questions that would avoid limiting or restricting the participants' responses.[17] The final question gave participants the opportunity to present new issues and to elaborate on discussed issues, regarding the

PHM program. The opportunity to elaborate on existing ideas and introduce new ideas was also allowed at anytime during the discussion.

### 2.2.3 Data Collection and Analysis

Conversations in the focus group sessions were tape recorded with concomitant note-taking by the moderator. [15] The tape-recording failed for the cardiology group, and the nurses were hesitant to being tape-recorded. Data analysis for these groups was conducted on data collected by note-taking. The cassette tape recording for the emergency physician and paramedic session was transcribed for review and evaluation.

Subsequent analysis of transcripts from all groups was conducted using the constant comparative method.[21,22] where multiple cycles of reading and applying labels or codes led to the development of common themes. Two researchers read the transcripts after each cycle of coding to increase reliability of analysis. [23]

### 2.2.4 Analysis of Transcripts

The transcribed material and the summary report was initially read by the moderator to become familiar with the content, and to scan for potential themes. A second reading of individual transcripts was conducted with the purpose of identifying and grouping phrases discussing similar issues. Identification and grouping was done by labeling each phrase with a brief description of the content or issue. Some phrases contained several different issues. These phrases were fragmented and placed in the relevant group. A list of the different arising descriptions was typed on a separate word document. All labeled phrases were copied and pasted under the corresponding description. These descriptions acted as "temporary themes". To ensure consistency of the analysis, the transcripts were sent to two reviewers for evaluation.

The third step involved combining similar temporary themes, and their respective phrases, from all the groups together. Temporary themes that did not have counterparts were also included, but as their own separate theme. These groupings were then defined as "sub-themes". The resulting 47 sub-themes were divided into two groups: "facilitators" if the contents contained views that supported PHM and "barriers" if the contents contained views that hindered the PHM process. Consistency of analyses were confirmed by two other investigator reviewers.

In the fourth and final process of organizing and analyzing the data, sub-themes with similar contents were combined into one group to form "Themes". This process yielded 12 themes. The sub-themes of 11 themes were scored or quantified, using the criteria in Table 2-1, for the purpose of: 1) providing a summary of the spectrum of issues raised by each group 2) demonstrating and comparing the magnitude of importance placed on each issue by each group.

Table 2-1: Criteria for Scoring Sub-themes

| Score | Criteria |
|---|---|
| ++ | Clear, decisive view that is supported by others in the group. A view that also stimulates supportive discussion |
| + | A view that is brought up at least once. A view that stimulates other varying or balancing views |
| 0 | No views or opinions brought up by a group on a particular matter |

## 2.3.0 Results

Six paramedics and four representatives from each hospital staff group participated. Focus groups sessions lasted 2 hours for paramedics, 1 hour for emergency physicians, 45 minutes for cardiologists and 30 minutes for emergency nurses.

Six factors that facilitate and five that constrain PHM are described below and summarized in Table 2-2. Selected supportive quotes to respective sub-themes are presented in Appendix 1. The "informed consent" theme was not scored due to the numerous discrepant perspectives emerging within and between groups; instead its analysis is presented independently.

### 2.3.1 Facilitators of Pre-hospital Management of STEMI Patients

2.3.1.a Benefits of PHM

All groups acknowledged that PHM reduced myocardial damage and decreased the chances of mortality by achieving early reperfusion. Benefits beyond direct patient care in areas such as cost to healthcare system and patients' time off work were also envisaged (Table 2-2 and Appendix 1: Facilitators of PHM, 1a-g).

2.3.1.b Medical overview and Team Relations

Physician overview of PHM was seen as a necessity since paramedics lacked the training and knowledge to make independent decisions on the type of therapy warranted for a particular patient. "As a paramedic there's nothing in my education that even prepares me for looking at two people and going okay for this guy, which is a better option primary PCI or thrombolytics in the field?" (PARA). The medical overview process; however, was seen as a team approach, based on consultation "it's the team approach which is coming in medicine… I think its using the team players to their

maximum and paramedics have the ability to do this, let's use their talent." (EP). Paramedics felt that rural paramedics formed closer working relationships with hospitals in the rural areas than in urban settings.

2.3.1.c Practical Aspects of PHM Process and Protocol

Knowledge of the PHM protocol among hospital staff would allow for an accurate assessment of a patient's condition and demonstrate respect for the paramedic profession. Emergency physicians demonstrated knowledge of the type of equipment and medication available to paramedics. Paramedics presented various sources of transportation delays such as traffic, warranting PHM. Setting benchmark times in the protocol was an idea suggested by cardiologists. Whereas, emergency nurses and emergency physicians believed that dedicating cardiologists at peripheral sites would be more effective than triaging in emergency departments.

2.3.1.d Training and Regular Maintenance of Competency

Regular maintenance of PHM knowledge and skills, especially through MI case simulations as discussed by paramedics and emergency physicians, was seen by all groups as an essential factor to improving PHM. One emergency physician stated that "…so as long as you have consistent training with … I guess its called continuing training, because, you know, it's a new program and everyone is hot for it, if you don't pick up a STEMI [patient] in a year, you know its all just going to be gone, so your skills will be gone…right." Participants also felt that frequent training sessions would help maintain the quality of service provided by paramedics, "And it comes down to QI [Quality Improvement] –you catch people who might not be doing a good job, you let them know. Comes down to ongoing training." (PARA).

2.3.1.e Paramedics' Willingness and Capability of Managing Acute MI patients

All groups expressed confidence in the paramedics' ability to provide effective PHM, while their ability to handle complications was acknowledged by cardiologists and emergency physicians: "Reperfusion arrhythmias or V-Fib [ventricular fibrillation] can be handled by paramedics" (CARD). In addition to knowledge and skill, the protocol-driven nature of PHM was also a contributing factor to capability, "it is protocol driven, so, it doesn't rely as much on the differing experience and 'have you ever seen this before?' Its going to be a 'this case, this case, this history (right EP), this ECG…– you know, 'are the vitals between this and this-'" (EP). Paramedics felt that their ability to save lives through PHM was professionally rewarding. "Now with identifying patients and…CPR or giving the drugs in the field, and it makes a huge difference to patient care. And that's rewarding, cause I think all of us are here to help people as best we can…" (PARA).

2.3.1.f Technological Assistance

Groups were overall content with the use and quality of the technological assistance, such as the ECG, available to expedite STEMI confirmation by a physician. "And we've had some excellent cases in the city where, they started, they did the serial 12 leads and the MI showed up." (PARA).

"ECG quality is generally good." (CARD). "Even though baselines are sometimes off, it's workable."(CARD).

### 2.3.2 Barriers to Pre-hospital Management of STEMI Patients

2.3.2.a Knowledge of PHM Process and Protocol

According to paramedics, some hospital staff, especially emergency nurses, lacked knowledge of the PHM protocol, resulting in a frustrating working environment because hospital staff were not prepared for an incoming patient. This was supported by the nurses who emphasized having an insufficient knowledge of the protocol.

Emergency physicians demonstrated some uncertainty in their knowledge while debating the basis upon which paramedics decide to bring an MI patient to the emergency room versus catheterization laboratory. In addition, no objections from colleagues occurred when one cardiologist suggested using pre-loaded TNK needles, indicating a lack of knowledge that TNK is a powder requiring reconstitution with water at the time of use. Paramedics also indicated that some of their colleagues felt that the literature had contradictory conclusions about STEMI-treatment approaches, as a result making them unwilling to administer PHM. (Table 2-2 and Appendix 1: Barriers to PHM, 1a-e).

2.3.2.b Practical Aspects of PMH of STEMI

Emergency physicians discussed the possibility of PHM to increase crowding in the emergency departments, especially at the tertiary centers. Paramedics felt that overcrowding did not occur due to PHM. They however, expressed concerns with MI patients' reluctance to take the ambulance due to cost and a sense of urgency to get themselves to the hospital. On the other hand, one paramedic suggested that the long wait times at the hospital deterred some MI patients from coming to the hospital all together. Educating the public on the benefits of calling an ambulance was seen as an important

concept, but paramedics felt that it was currently ineffective. One paramedic asked if "…there's a bigger role for us, the paramedics, in that process [public education]…?"

Paramedics also discussed instances of a break in the chain of communication between the paramedics and hospital staff during patient transport to the hospital. "Typically sometimes what happens is, you get to emerg [emergency department] and somebody didn't contact somebody (yeah), and then you're sitting there going 'well I have this patient that's enrolled in this study, or, that I've, is Vital Heart [STEMI patient]' and they're [hospital staff] going 'mmm, we don't know anything about him.'" (PARA).

2.3.2.c Ownership and Responsibility of Patient Care

Varying perspectives on ownership and responsibility for PHM patients were shared. Cardiologists felt that the responsibility for manning the response line belonged to the emergency physicians, while emergency physicians felt the opposite. Emergency nurses and paramedics felt that both physicians groups would be appropriate. Emergency groups felt PHM patients should be taken directly to the Coronary Care Unit (CCU) or catheterization laboratory, instead of being triaged in the emergency department.

Paramedics lacked a sense of ownership over their patients. "I treated this guy at his worst. And now I can't even find out if he is still at the hospital." (PARA).

2.3.2.d Capability and Interest of Paramedic to Provide PHM

Doubts were raised over the ability of some paramedics to provide PHM. According to one emergency physician, "the opinion of outside…sources are not always trusted or the state of the patient as relayed to them [colleague physicians] by consult or phone is not always trusted". This group also expressed concern in paramedics' inability

to appropriately identify STEMI on ambiguous symptoms or ECG readings, resulting in valid cases to be overlooked. Emergency nurses perceived rural paramedics to make more identification and treatment errors because they were paid less and received poorer standards of training than urban paramedics. "Paramedic services in the rural areas, like from a 100 miles out, may not be strong in identifying STEMI." (RN). "It might not be appropriate for them to carry out PHM. Their learning curve is greater." (RN). "It also comes down to how much they get paid. The ones in the rural areas get paid half as much, so their quality of training and capability of providing care isn't as good." (RN).

Paramedics suggested that some colleagues' apprehension towards PHM may stem from being "chastised" by their preceptors about making a mistake. In addition, they felt that while colleagues with more experience were willing to manage STEMI than their counterparts, they were less confident about using new technologies. On the other hand, recent graduates were more likely to be technologically inclined, but less confident to manage STEMI.

2.3.2.e Technological Assistance

Emergency physicians and paramedics recalled instances of ECG transmission failure to the response-line; "… I've seen crews where they tried twice to fax and it didn't work, and its like 'screw this'." (PARA). On the other hand, paramedics also felt that the failure of some paramedics to use the technology appropriately limited PHM implementation.

**2.3.3 Informed Consent**

All but one person argued against obtaining a signed informed consent from patients during PHM as it was thought to be redundant to the perceived "implied consent"

from calling 911 and infeasible since patients were distressed. Groups also noted that its absence for in-hospital fibrinolysis and questioned its necessity if PHM was "standard of care".

However, it was recognized that consent was currently in place to safeguard against possible liabilities; "who knows, it could've been driven by our management. That's a liability risk management from their point." (PARA). Cardiologists and paramedics suggested that if consent were to remain as part of PHM, it needs to be succinct.

## 2.4.0 Discussion

Successful integration of PHM of STEMI including pre-hospital fibrinolysis in the "real world" setting includes understanding barriers and establishing a unified understanding between stakeholders. In our study, a general consensus emerged amongst stakeholders that PHM reduces time-to-treatment, and improves the health outcomes of STEMI patients. Groups felt that most paramedics were capable of executing appropriate patient identification, eligibility check list completion and therapy administration, while medical overview was important to confirm MI diagnosis. Formal intermittent reviews of PHM by paramedics and hospital staff in direct care of these patients was seen as a facilitator of the program. Although the concept of ownership of patients was raised consistently by all the stakeholders, dissonance existed in areas such as, triage of patients to the emergency room and appropriate physician staffing of the remote response line. Incongruency in perceptions between groups, and lack of knowledge of the process by some group members may act as a barrier towards acceptance. Instances of technological failures during ECG transmission were identified as one of the barriers.

Resonating with other studies,[12,13,14] paramedics in our study were enthusiastic about the benefits of PHM to the patients and to the paramedic profession, despite countervailing issues. In Humphrey's survey, the majority of paramedics overestimated the risks of mortality and morbidity associated with fibrinolysis.[13] These misperceptions may make the paramedics less inclined to provide PHM, as such, implementing appropriate means to correct these misconceptions may eliminate a barrier to PHM. This study did not explore issues regarding technology and paramedic-hospital staff relations which were perceived to be important aspects of PHM in our study. The focus group study by Helen et al. reported primarily on elements of paramedics' perception of their professional status as the participants were not exposed to PHM. Paramedics felt that PHM foster a united working relationship with physicians and increase their professional status.[14] Paramedics in our study felt that this would make their image as patient care providers more credible to the public, who would in turn be more willing to use their services. The increase in credibility was attributed, in part, to the quality of paramedic education. As such, this sense of pride and inter-professional cooperation needs to be developed through innovative programs.

Paramedics in the study by Price *et al.* felt that the added responsibility of PHM should stimulate a pay increase.[12] Distinctively, the paramedics in our study found motivation in the opportunity to improve patient outcomes. In fact, they suggested increasing their sense of patient-ownership by introducing a registry program to track patients.

An enhanced understanding of both the pre-hospital and in-hospital realm by emergency physicians suggests that this group should be included in efforts to enhance

integrative and collaborative practices. Ironically, emergency physicians felt that PHM patients should bypass the emergency department and be sent directly to the CCU or catheterization laboratory. This view stems, in part, from the perception PHM may increase crowding in the emergency departments. Overcrowding and resource scarcity have become key barriers for patients receiving timely care.[24,25,26] Although ambulance diversion systems are typically employed to manage ambulance traffic during periods of overcrowding, the resulting increased distance to travel to the next closest hospital inevitably results in treatment delay.[27] With the advent of PHM the opportunity to improve patient outcomes with administration of definitive treatment despite the possibility of ambulance diversion becomes apparent.

The cardiologists suggested imposing benchmarks for key steps in the PHM protocol. Although this maybe a reasonable approach in an ideal setting where many of the scenarios are similar, paramedics indicated that there are many uncertainties and unpredictable events during an emergency call. It has been suggested that focus on benchmark times may be perceived to take the priority away from providing quality care.[29]

Emergency nurses' lack of trust in the rural paramedics' ability to carry out PHM as effectively as urban counterparts may be rooted in their experience, or may reflect preexisting biases or inadequate interaction with this group. Addressing this issue is important as programs expand not only in urban centers across North America, but rural centers where PHM will have the biggest gain with respect to time reduction according to participants.

Discussion of the signed informed consent process was also unique to our study, with the majority of the participants against it. The impractical nature of obtaining a signed consent from a distressed patient and the fact it was also deemed unnecessary if PHM was 'standard of care' was identified in our work. Holding public awareness programs on the benefits and process of PHM of STEMI may help address these issues. Rationalizing the necessity of the consent form to the stakeholders may patch a void in knowledge and prevent a possible barrier.

### 2.4.1 Limitations

We employed a qualitative method of study design for this study, accepting that there are limitations to this approach. Bias may be present as participants volunteered to participate despite being randomly selected. Secondly, due to a technological failure, one group was not recorded, and the session was analyzed from notes. Thirdly, we introduced an approach of quantifying qualitative data for ease of tabulation considering four different study groups, accepting that there are challenges and limitations to this approach. Lastly, we recruited four to six participants in this study. Although this group size is more comfortable for participants, there is a limit in the range of experience.[29]

### 2.4.2 Implications

Results from this study can have a direct impact on establishing stake-holder buy in, by addressing any barriers or misconceptions that emerged from the focus groups. An effective PHM protocol can be designed for all stakeholders to ensure a unified understanding. In addition, a public awareness program, based on the focus group, can also be implemented to educate patients at risk of STEMI to call an ambulance on an ensuing chest pain. Moreover, key concepts derived from this study have been used to

developing a questionnaire to explore the perceptions within the region (Chapter 3). Issues arising from this study could be used to facilitate the expansion PHM for STEMI.

Table 2-2: Categorized Themes and Scored Sub-themes.

| Barriers to PHM | EP | PARA | CARD | RN |
|---|---|---|---|---|
| **1.Knowledge of PHM process and protocol** | | | | |
| **Sub-themes included:** | | | | |
| a. Lack of knowledge (or uncertainty) on aspects of the PHM protocol | ++ | 0 | + | + |
| b. Perception that focus on PHM will be robbing from trauma | + | 0 | 0 | 0 |
| c. Perception that some hospital staff are unaware of PHM protocol | 0 | ++ | 0 | 0 |
| d. Incongruency in literature or understanding of literature on MI therapy | 0 | ++ | 0 | 0 |
| e. Lack of knowledge of paramedic team protocols | + | 0 | 0 | 0 |
| **2.Practical aspects of PHM** | | | | |
| **Sub-themes included:** | | | | |
| a. Perception that PHM will have no effect and/or will increase overcrowding in Emergency department | + | + | 0 | + |
| b. Perception that MI patients will avoid taking EMS due to cost | + | + | 0 | 0 |
| c. Perception that Patients with MI will avoid going to the hospital due to wait times | 0 | + | 0 | 0 |
| d. Perception of lack of communication between paramedic and hospital | 0 | + | 0 | 0 |
| **3. Ownership and taking responsibility of patient** | | | | |
| **Sub-themes included:** | | | | |
| a. Negative perceptions about steps in the protocol (i.e. PHM diagnosed patient stopping at the emergency department for triage | + | 0 | 0 | 0 |
| b. Perceptions on ownership of and taking responsibility of patient | ++ | + | + | + |
| **4. Capability and interest of paramedic to provide PHM** | | | | |
| **Sub-themes included:** | | | | |
| a. Skepticism (lack of trust) in some Paramedic to carry out PHM effectively | ++ | ++ | 0 | 0 |
| b. Perception that some paramedics in rural areas are not capable of effectively providing PHM | 0 | 0 | 0 | ++ |
| c. Perception of paramedic misdiagnosis | ++ | + | 0 | + |
| d. Perception that paramedics inability to handle complications (or situations outside of protocol) will cause problems. | + | 0 | 0 | 0 |
| e. Perception that some physicians maybe resistant to PHM | + | 0 | 0 | 0 |
| f. Perception that some paramedic will be disappointed by VHR physicians' decisions | 0 | ++ | 0 | 0 |

| Barriers continued | EP | PARA | CARD | RN |
|---|---|---|---|---|
| **5. Technological assistance** | | | | |
| **Sub-themes included:** | | | | |
| a. Perception of technological failures inhibiting ability to mange patient | + | ++ | + | 0 |
| b. Knowledge of technical problems as a barrier to PHM | 0 | ++ | 0 | 0 |
| **Facilitators of PHM** | EP | PARA | CARD | RN |
| **1. Benefits of PHM** | | | | |
| **Sub-themes included:** | | | | |
| a. Knowledge that expertise is brought to patients with PHM | + | + | 0 | 0 |
| b. Perception that PHM may increase the flow of in-hospital patient treatment | + | 0 | 0 | 0 |
| c. Perception that PHM may decrease in-hospital workload | + | 0 | 0 | 0 |
| d. Perception that PHM may increase the number of people talking ambulances during a heart attack with public awareness programs | + | + | + | 0 |
| e. Perception that PHM process will benefit patients even if there are contraindications to drug use | 0 | + | + | 0 |
| f. Perception that PHM will decrease cost to healthcare system | 0 | + | 0 | + |
| g. Knowledge of clinical benefit (including reducing time to treatment) | ++ | ++ | + | + |
| **2. Medical overview and team relations** | | | | |
| **Sub-themes included:** | | | | |
| a. Integrating key players to form a team approach (accepting paramedic as 'equals') or (understanding the importance of a good physician-paramedic relationship) | + | ++ | 0 | 0 |
| b. Perception that medical overview is needed to ensure effective treatment of patient in the field | ++ | ++ | + | ++ |
| c. Perception that paramedic may have better access to cardiologists than emergency physicians | 0 | ++ | 0 | 0 |
| d. Perception of sound communication between paramedic and hospital | 0 | + | 0 | 0 |
| e. Perception that rural paramedics have a closer relationship than urban paramedics with respective hospital | 0 | 0 | ++ | 0 |
| **3. Practical aspects PHM process and protocol** | | | | |
| **Sub-themes included:** | | | | |
| a. Knowledge of some EMS protocols | ++ | ++ | 0 | 0 |
| b. Perception that a simplified protocol for the stake holders will facilitate PHM | 0 | 0 | ++ | + |
| c. Knowledge of real life field experience or knowledge of source of delays to treatment | 0 | ++ | 0 | 0 |
| d. Perception that placing cardiologists at peripheral sites will facilitate PHM | + | 0 | 0 | + |
| e. Perception that setting benchmark times for steps in the protocol is needed | 0 | 0 | ++ | 0 |
| f. Consistency of STEMI treatment protocol (prehospital versus inhospital) | 0 | + | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| **4. Training and regular maintenance of competency** | | | | |
| **Sub-themes included:** | | | | |
| a. Perception that continuous training (to maintain skills) by paramedic will facilitate PHM | ++ | ++ | ++ | ++ |
| b. Perception that simulations may complement real life exposure to MI cases to maintain competency | ++ | ++ | 0 | 0 |
| c. Perception that increasing the quality of paramedic education program is needed to promote confidence | 0 | ++ | 0 | 0 |
| d. Knowledge that one must be critical of results published in the literature | 0 | + | 0 | 0 |
| **5. Paramedics' willingness and capability of managing acute MI patients** | | | | |
| **Sub-themes included:** | | | | |
| a. Perception that paramedics are capable of providing pre-hospital care to acute MI patients | ++ | ++ | + | ++ |
| b. Paramedic's ability to handle bleeding (complication) | + | 0 | ++ | 0 |
| c. Paramedic will find added responsibility of providing PHM as professionally rewarding | 0 | ++ | + | 0 |
| d. Knowledge that PHF is protocol driven and perception that STEMI is not too difficult to treat | ++ | ++ | 0 | 0 |
| **6. Technological assistance** | | | | |
| **Sub-themes included:** | | | | |
| a. Perception that technology is a positive factor in PHM | 0 | + | 0 | 0 |
| b. Confidence in ECG technology and transmission | 0 | 0 | + | 0 |
| | | | | |

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# Chapter 3

## Evaluation of the Attitudes and Perceptions of Paramedics, Cardiologists, Emergency Nurses and Emergency Physicians Regarding Pre-hospital Diagnosis, Triage and Treatment of STEMI Patients Using a Region Wide Survey

### 3.1.0 Introduction

Acute myocardial infarction accounts for approximately 20% of all deaths in Canada.[1] Intravenous fibrinolytics have been a cornerstone of a reperfusion strategy[2-4] where maximal effectiveness of therapy on clinical outcomes is achieved when treatment is initiated early; i.e., benefit of fibrinolysis is decreased by nearly 50% when administration is delayed from the first hour to the second hour from symptom onset.[5] Advanced pre-hospital management including fibrinolysis (PHM) is feasible and is consistently demonstrated to improve clinical outcomes through reduction in treatment delay. However, with the exception of a few centers, there remains a paucity of integrated PHM in North America.[6]

Knowledge of underlying barriers to PHM implementation in North America has not been explored until our recent focus group study identifying the perceptions of paramedics, cardiologists, emergency nurses, and emergency physicians on PHM. Accepting the limitations of the small focus group sample size on generalizability, we sought to move forward to capture the views of a larger sample of each group using a questionnaire that was based upon the focus group observations. Insights from this study will help address gaps in knowledge, thereby improving implementation of current PHM programs and potentially facilitating expansion of PHM across North America.

## 3.2.0 Methods

Prior to distribution of questionnaire-surveys to the target population, suitable question items need to be generated, appropriate formatting and response scale need to be selected, and the questionnaire should be validated and pre-tested.[7] Our completed survey instrument can be viewed in Appendix 2. Ethics approval for this study was received from the University of Alberta's Human Research Ethics Board.

### 3.2.1 Item Generation for a Questionnaire-Survey

Researchers have two methods of selecting items most suitable for the development of a new survey: factor analysis and clinical importance.[8,9] Factor analysis involves a mathematical model to determine the inclusion and exclusion of items. Items correlating highly with one another are included, whereas those that do not, are excluded. The main disadvantage of this method is that statistical significance (rather than clinical significance) determines selection of items. As a result, items that may be important to the participant are excluded because they were not statistically significant.[8]

Selecting items based on clinical importance is a method that we adopted. Judgment on importance was based on the issues that participants in the target group identified. Our previous use of focus group methodology was useful in this process as the relative importance of each item was indicated by the depth of discussion around it. In addition, a novel method of quantification of focus group data allowed us to determine the magnitude of importance each group placed on an item. Further input on important issues that should be considered in the survey came from members of the study's investigation team, as two of the members are highly involved in the regional PHM

program. Furthermore, previously published articles discussing issues surrounding PHM implementation were examined for relevant information.[10,11,12]

### 3.2.2 Survey Composition

Once the items for the survey were chosen, they were converted into statements that can elicit a response. The following recommendations from the literature were taken into account while creating the question stems [13,14] 1) phrase questions in a self-explanatory manner, 2) restrict questions to closed answers, 3) avoid varying response scales, 4) avoid biases that may predetermine a respondent's answer, 5) avoid double negatives and ambiguous wording 6) and avoid double-barreled questions. In addition, the print should be "crisp and clear" and there should be double spacing between items to facilitate reading and completion.[17] Furthermore, questions should be phrased so they can be understood by all responders. Data from focus group transcripts were useful for selecting the language and terms familiar to participants, which can be used in the formation of questions. [15,16]

Survey questions were grouped into nine themes (Table 3-1): Benefits of PHM, Practical Aspects of PHM, Knowledge of PHM Process, Ownership and Responsibility, Technology, Capability and Willingness, Medical Overview and Team Relations, Informed Consent, and Training and Regular Maintenance of competence.

Table 3-1: Placement of Theme-based Question Stems in the Questionnaire-Survey.

| Theme | Question Numbers |
|---|---|
| Clinical Benefits of PHM | 1, 2, 7, 9, 12, 17 |
| Paramedics' Capability and Willingness (to perform PHM) | 3, 9, 16, 20 |
| Informed Consent Process | 4, 13 |
| Medical Overview and Team Relations | 5, 15, 23 |
| Ownership and Responsibility (of APHM patients) | 6, 14, 19, 22 |
| Knowledge of PHM process | 8, 11, 25 |
| Practical Aspects of PHM | 21 |
| Technology | 24 |
| Training and Maintenance of Competence | 18 |

### 3.2.3 Response Options

Items are ascribed with scales to allow quantitative discrimination among subjects in relation to the attributes being measured. Likert scales are common, and are comprised of a set of related declarative statements in which respondents are asked to indicate their extent of agreement or disagreement with each statement.[7] A Likert scale can have even or odd number of responses. Although a 5 item scale, or the 5-point Likert scale, is widely used,[13] some researchers prefer the use of an even number of response options so that "fence-sitters" are forced to express an opinion. It is recommended that a neutral scale position should be used only if it is conceptually meaningful for the attribute being measured.[7]

In our study, a four-point Likert scale comprising of four choices (Strongly Agree, Agree, Disagree and Strongly Disagree) was used, and responders were asked to select the response that best reflected their views on each question.

### 3.2.4 Pre-testing the Instrument

It is recommended that questionnaires should be pre-tested on 10-20 individuals with characters similar to the general target population.[7] This process allows researchers to

detect problems with wording of question stems, clarity of instructions, readability of the questionnaire, completion time of questionnaire, and to detect any offensive items.[7]

In our study, a pre-testing survey was given to a group of 21 physicians in the area of cardiology, internal medicine, and emergency medicine for completion and feedback. Upon receipt of feedback, ambiguous wordings and phrases were exchanged for more explicit vocabulary and phrases, and redundant question stems were dropped. The final survey contained 25 question stems.

### 3.2.5 Validity

Assessment of validity is necessary to ensure that the instrument is measuring what it intends to measure. There are four types of validity: face validity, content validity, criterion validity and construct validity.[9,14]

To evaluate face validity, the instrument was circulated to the pre-test group and investigators of this study. Recipients were asked to ensure that important factors regarding pre-hospital management of STEMI patients were not missing.

Content validity was achieved as question stems were based on issues arising from the focus group sessions and input from members from the regional PHM steering committee. Focus groups were used for their high level of content validity.[8]

The assessment of criterion validity involves correlating a new instrument with a "gold standard". However, since a gold standard instrument to assess factors influencing PHM implementation does not exist, assessment of criterion validity is not possible in this study. In addition, our survey does not contain a defined construct or factor that influences an observable behaviour. As a result, the assessment of construct validity was ruled out.

### 3.2.6 Survey Distribution

Surveys, accompanied with stamped-return envelopes, were distributed through mail to members of stakeholder groups (paramedics, cardiologists , emergency physicians and nurses) across the Capital Health Region, upon approval of authorities from respective groups (i.e., EMS site chiefs, cardiology divisional directors, emergency department physician site chiefs, and emergency nurses patient care managers).

Surveys were distributed using two different approaches, upon request and approval from respective group authorities. All emergency physicians and cardiologists, and one of the two emergency nurse groups received confidential surveys, as we were able to obtain a list of names that was verified by respective authorities. For all paramedics and the second group of emergency nurses' group, respective authorities did not provide a list of names, but instead requested a defined number of surveys to be distributed to group members.

Names of individuals receiving confidential surveys were matched with an identification number by an individual not part of the study (to keep the investigators blinded). Therefore, non-responders in the confidential surveys were tracked, while preserving the anonymity of those who have responded. Surveys received from anonymous mail-outs were also given an identification number upon arrival for data entry purposes.

Surveys were distributed at a minimum of two waves and a maximum of three waves (upon direction of authorities), to both anonymous and non-responding confidential groups, to allow for a maximal response rate.

### 3.2.7 Survey Analysis

Completed surveys were entered on a Microsoft Access ® database. Subject's responses on the ordinal, 4-point scale (SA, A, D, SD) were converted to an interval scale (SA = 1, A = 2, D = 3, SD = 4) for analysis. SA and A, D and SD were combined for statistical analysis to compare levels of overall agreement and disagreement expressed by each group on a question stem. Chi-squared and Fisher's exact test were used to measure statistical significance in responses between each group.

### 3.3.0 Results

A total of 69% of paramedics [190/275: Advanced Cardiac Life Support (ACLS) 164/275 and Basic Life Support (BLS) 26/275], 50% of cardiologists (26/51), 54% of emergency physicians (57/109), and 44.5% of emergency nurses (82/184) replied to the questionnaire with an overall response rate of 57.3% (355/619). Summarized results are displayed on table 3-2. In the results presented below, responses in percentages are combined for strongly agree (SA) and agree (A), and disagree (D) and strongly disagree (SD), unless stated otherwise.

The majority felt that PHM reduces treatment delay for STEMI patients in both rural (96 -100%) and urban areas (86 - 96%). A majority also felt that PHM decreases patient morbidity (92 - 96%), while an inconsistent majority felt that PHM decreases patient mortality (PARA 97%, CARD 74%, EP 85%, RN 88%). In contrast to PARA (67%) and RN (77%), a small minority of CARD (48%) and EP (44%) felt that pre-hospital STEMI identification (without treatment), reduces in-hospital time-to-treatment to the same extent as PHM with treatment.

While a majority of participants from each group agreed that the literature provides adequate evidence to support the efficacy of PHM and guidelines for STEMI treatment, with the exception of PARA (94%), a relatively modest majority (59-70%) expressed confidence in their knowledge of the existing regional PHM protocol. In addition, a large majority agreed that ALS paramedics are capable of obtaining (100%: PARA 97% SA, CARD 100% SA, EP 100% SA, RN 69% SA) and interpreting (PARA 99%, CARD 83%, EP 75%, RN 93%) 12-lead ECGs, and administer fibrinolytics (89 - 100%). Divergent responses regarding the capability of urban and rural paramedics to

deliver PHM were identified with PARA 24%, CARD 52% (0% SA), EP 69% and RN 53% (12% SA), stating that urban paramedics are better equipped and trained than rural paramedics. In addition, this question stem had the least number of responses from each group compared to other question.

Almost all (98-100%, 43-68% SA) felt that a formal intermittent review of the regional pre-hospital STEMI treatment protocol is a facet adding to the program's success.

When presented with the concept of paramedics diagnosing and treating STEMI patients including fibrinolysis without physician overview, almost all the hospital stakeholders (CARD 100%, EP 98%, RN 95 %) and 76% of PARA opposed it. Groups similarly accepted that there was effective communication and collaboration between PARA and hospital staff (74-85%), and were inclined towards the idea that physicians manning the response line must familiarize themselves with the EMS community (96-100%).

A modest majority of PARA and RN preferred both emergency physicians (68-72%) and cardiologists (58-62%) to man the response line. Half of the CARD favoured cardiologists to man the response line (50%, 19%SA), while a minority preferred emergency physicians (42%, 0%SA). On the contrary, a majority of EP supported an emergency physician (62%, 5%SA ) man response line, while 30% (SA) supported cardiologists.

The minority of PARA (18%), CARD (27%), and RN (38%) felt that all pre-hospital diagnosed STEMI patients requiring mechanical reperfusion should be assessed

first in the Emergency Department in contrast to EP (54%). A quality assurance program to track time-to-treatment of STEMI patients was favoured by all groups (99-100%).

A small minority of PARA and CARD (32 and 25%), and a smaller minority of EP and RN (7 and 13%) felt that PHM decreases crowding in the emergency department.

Groups consistently expressed confidence in the technology to transmission pre-hospital ECG recordings to the physician providing interpretation (70–84%).

### 3.4.0 Discussion

In our investigation, stakeholders agreed that PHM is associated with improved health outcomes. The majority of participants felt that paramedic-based PHM reduces treatment delay in both rural and urban regions. These views are consistent with those captured from stakeholder groups in our previous focus group study, and from studies demonstrating significant time-to-treatment[17] and mortality reduction.[18,19]

Even without fibrinolysis, a majority of PARA and RN, and half of both CARD and EP, felt that identification of STEMI in the pre-hospital setting can reduce in-hospital time-to-treatment. In a practical context, the identification of STEMI in the field can reduce reperfusion delays by attenuating door-to-balloon time for PCI by one hour or more compared to STEMI patients diagnosed in-hospital.[20,21,22] Interestingly, only EP (54%), felt that all pre-hospital diagnosed STEMI patients requiring urgent cardiac catheterization should be first assessed in the Emergency Department. Insights from some EPs in our previous focus group felt that direct transfer to the cardiac catheterization laboratory would reduce treatment delay, an idea supported by a recent studies conducted in France and Canada where patients received earlier PCI.[4, 23] Although by-passing the emergency department for primary PCI would be an ideal strategy, it relies on timely cardiac catheterization laboratory set up and staff availability continuously throughout the day. However, consistent timely PCI availability remains a challenge.[24]

Although participants largely agreed that PHM did not decrease crowding in the Emergency Department, fibrinolytics initiated in the ambulance may be beneficial to STEMI patients outcomes during ambulance diversions in the case of crowded Emergency Departments.[25]

Despite expressing overall confidence in ALS paramedics' to carry out key steps in PHM, concerns were raised regarding rural paramedics training and equipment capabilities by a moderate majority of CARD, EP and RN. This matter needs to be assessed, as the nearest PCI capable hospital or Emergency Department in rural regions may exist hours away.

Familiarity of the EMS community by the physician providing remote paramedic overview was seen as an essential aspect of PHM. Programs to facilitate familiarity such as, organizing several ambulance 'ride alongs' with PARA teams, need to be explored. Furthermore, approximately 15 to 25% of participants within each group disagreed with the statement that there is currently an effective communication and collaborative working relationship between stakeholder groups, having implications on effective patient care. A previous study reported that the major inhibitor to developing nurse-physician relationships was the substantial gain or loss of physicians, resulting in nurse managers having trepidations teaching them how to work in the existing nurse-physician environment.[26] However, the source for the sentiments within this multi-professional group needs to be thoroughly explored.

In our current PHM program, both EP and CARD have shared responsibilities in providing remote PHM overview by manning the response line. Despite both specialties' ability to fulfill the task, all groups demonstrated an overall modest support for CARD (CARD 50%, EP 30%, PARA 59%, RN 62%), while a relatively stronger overall support for EP as the response line physician was demonstrated by all (EP 52%, PARA 72%, RN 68%) except CARD (42%). However, the percentage of participants "strongly agreeing" to a CARD manned response line moderately exceeds the percentage of individuals

strongly agreeing to an EP manned response line (19-5-17-24% SA for CARD vs. 0-5-17-20% SA for EP). This relatively higher frequency of SA for CARD balances the higher overall support for EP. These sentiments may relate to differences in collaborative and communicative nuances that exist amongst stakeholder groups especially the understanding of unique aspects of the pre-hospital environment, which need to be explored. One aspect clearly identified by all was the need for PHM physician overview. However, differences in these opinions regarding the physician responsible for overview may reflect the complex decision making process involved in STEMI patient treatment. To clarify this issue future surveys to stakeholders should explicitly provide options for "emergency physicians, cardiologists, or both."

Despite the majority of members reporting confidence in their own knowledge of the STEMI protocol, it is worth noting that the smallest majority (59%) emerged from EP. If this is certain, then this lack of knowledge bears negative implications on STEMI patient care as EP need to understand key information before deciding the best approach on subsequent in-hospital treatment of PHM treated STEMI patient.

In our previous focus group study, a majority of participants were against obtaining a signed informed consent prior to PHM and fibrinolysis due to reported issues relating to time consumption, and infeasibility of obtaining consent from STEMI patients who were likely to be under physiological and psychological stress. Focus group participants also felt that that calling 911 implied consent for treatment. Contrary to the focus study, the majority of stakeholders in this study felt that a signed informed consent was necessary in the pre-hospital setting. Also at variance with a focus group observation is the magnitude of response of emergency nurses presented with respect to rural

paramedics. The emergency nurses in the focus groups unanimously felt that rural paramedics were not able to provide PHM as effectively as their urban counterparts due to poor training. However, in the survey only 53% of emergency nurses shared this view along with 24% of PARA, 53 % of CARD, and 69% of EP. To confirm or refute these views STEMI case scenario-based tests can be given to both rural and urban paramedics to address clinical decision making.

The views of paramedics in our study regarding the capability of paramedics to provide PHM were in line with a previous survey study by Humphrey et al.[11] A large majority of paramedics in both studies (>98% ours, >82% Humphrey et al.) felt that paramedics are capable of obtaining and interpreting 12 lead ECGs, and administering thrombolysis in the pre-hospital setting. Paramedics' confidence in their ability to provide PHM is important in implementing and maintaining a successful paramedic based PHM program. Knowledge of paramedics' level of confidence is important as a high level of confidence can be maintained through recognition of efforts and continued delegation of appropriate responsibilities. With lower levels of confidence, underlying issues can be explored and corrected with appropriate interventions. The differences in the level of agreement between the paramedic groups may be partly explained by the status of an implemented PHM program in both studies. The paramedics in our study have conducted PHM within a clinical and research setting for approximately 8 years, whereas the paramedics in the previous study have not been part of a PHM program. This exposure to PHM may have further developed the confidence in paramedics to carry out PHM.

The survey by Humphrey *et al.* reported that 63% of paramedics felt that they would need to administer fibrinolysis once per month to retain their skills.[11] In our focus

group study, paramedics explained that they did not frequently and consistently see enough STEMI patients to maintain their knowledge and skills of providing PHM. However, they strongly suggested that implementing frequent simulations of PHM complement treating patients with STEMI. This information was added to our survey and 98% of PARA, and 98-100% of hospital staff felt that formal intermittent reviews of the PHM protocol was key to the program's success. This avenue of maintaining PHM knowledge for both paramedics and hospital staff in direct care of patients with STEMI needs to be explored.

### 3.4.1 Limitations

Although surveys were sent to as many stakeholders as possible within the target population, not all individuals responded to each survey. In addition, of those who responded, some did not answer all the questions. As such, this leaves the possibility of volunteer bias in our study. Further more, we attempted to keep all aspects of survey distribution consistent amongst groups; however, some were received confidentially and others anonymously. It is possible that individuals from each group may have responded differently, despite investigators being unable to match surveys with responders in each case as investigators were blinded to participants responding to confidential surveys. Moreover, in directing participants to either generally agree or disagree (albeit varying levels of agreement and disagreement), the varying number of responses from each group on questions stems may reflect non-responders lack of knowledge to make a decision. This was indicated by some individuals who wrote "don't know" beside some question stems. In addition a 25 question survey with a 4-point Likert scale limits the depth of discussion on each issue; however, an open comments section was provided for

participants to elaborate on their perspectives. Three of our survey questions were 'double barreled' and may have resulted in a situation where a responder agreed with one component and not the other. This maybe more likely with the question dealing with the differences in rural and urban paramedics level of equipment and training – where both components (training and equipment) can exist independently. However, for the question dealing with the ability of paramedics to safely and accurately administer fibrinolytics, being accurate is a component of being safe.

### 3.4.2 Implications

This study captured the views of all stakeholder groups on key issues relating to PHM implementation. In addition, perceptions obtained from a larger sample size may be more reflective of the target population than our previous focus group study. Identified barriers and facilitators, and misconceptions can be addressed through stakeholder educational programs and changes in PHM policy. Furthermore, perceived barriers or facilitators arising from this study can be confirmed as misconceptions or actual factors through subsequent clinical trial experiments, or analysis of existing clinical trial data. Minimization barriers and adopting facilitating factors to PHM can make an existing PHM program effective , resulting in a further reduction in time-to-treatment, and can facilitate implementation of PHM programs national

## Table 3-2: Stakeholders' Response to Survey Items

| Question | CARD n=26 | | | | | EP n=57 | | | | | PARA n=190 | | | | | RN n=82 | | | | | p-val* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | SA | A | D | SD | n | SA | A | D | SD | n | SA | A | D | SD | n | SA | A | D | SD | |
| **Clinical Benefits of PHFL** | | | | | | | | | | | | | | | | | | | | | |
| Pre-hospital fibrinolysis decreases patient morbidity (e.g. congestive heart failure) | 24 | 42 | 50 | 8 | 0 | 56 | 18 | 77 | 5 | 0 | 88 | 34 | 62 | 3 | 1 | 80 | 31 | 63 | 5 | 1 | 0.3949 |
| Pre-hospital fibrinolysis reduces *symptom-to-treatment* time in rural areas | 25 | 72 | 28 | 0 | 0 | 57 | 54 | 46 | 0 | 0 | 90 | 61 | 35 | 4 | 0 | 81 | 58 | 39 | 3 | 0 | 0.3667 |
| Pre-hospital fibrinolysis reduces *symptom-to-treatment* time in urban areas | 26 | 35 | 61 | 4 | 0 | 57 | 17 | 72 | 11 | 0 | 85 | 31 | 60 | 9 | 0 | 81 | 28 | 58 | 11 | 3 | 0.4443 |
| Pre-hospital fibrinolysis decreases patient mortality (death) | 23 | 17 | 57 | 26 | 0 | 48 | 17 | 69 | 14 | 0 | 83 | 39 | 58 | 3 | 0 | 78 | 27 | 61 | 11 | 0 | <0.000001 |
| In your health care region, there are enough myocardial infarction cases a year to warrant pre-hospital fibrinolysis | 26 | 35 | 65 | 0 | 0 | 56 | 16 | 71 | 11 | 2 | 87 | 62 | 36 | 2 | 0 | 80 | 44 | 49 | 7 | 0 | 0.0066 |
| Pre-hospital 12-lead ECG and identification of STEMI reduces in-hospital *time-to-treatment* to a similar degree as pre-hospital fibrinolysis | 25 | 8 | 40 | 44 | 8 | 56 | 4 | 41 | 53 | 2 | 84 | 19 | 48 | 28 | 5 | 79 | 14 | 63 | 23 | 0 | 0.0003 |
| **Paramedics' Capability and Willingness** | | | | | | | | | | | | | | | | | | | | | |
| Advanced Life Support (ALS) paramedics are capable of obtaining a 12-lead ECG in the pre-hospital setting | 26 | 61 | 39 | 0 | 0 | 57 | 40 | 60 | 0 | 0 | 90 | 93 | 7 | 0 | 0 | 82 | 69 | 31 | 0 | 0 | No difference |
| ALS paramedics are capable of safely and accurately administering required medications (i.e. IV anticoagulant and fibrinolysis) to pre-hospital STEMI patients | 25 | 16 | 84 | 0 | 0 | 57 | 14 | 75 | 9 | 2 | 87 | 70 | 29 | 1 | 0 | 79 | 33 | 62 | 5 | 0 | 0.0012 |
| Urban paramedics are better equipped and trained than rural paramedics to assess and treat pre-hospital STEMI patients | 21 | 0 | 52 | 43 | 5 | 55 | 9 | 60 | 29 | 2 | 86 | 4 | 20 | 47 | 29 | 75 | 12 | 41 | 44 | 3 | <0.0001 |
| ALS paramedics are capable identification of ST elevations and preliminary interpretation of pre-hospital 12 lead ECGs | 24 | 17 | 66 | 17 | 0 | 56 | 11 | 64 | 25 | 0 | 88 | 72 | 27 | 5 | 5 | 81 | 31 | 62 | 5 | 2 | <0.000001 |
| **Informed Consent Process** | | | | | | | | | | | | | | | | | | | | | |
| A signed informed consent prior to fibrinolysis is necessary in the pre-hospital setting | 26 | 19 | 54 | 23 | 4 | 57 | 28 | 49 | 19 | 4 | 90 | 48 | 38 | 13 | 1 | 80 | 42 | 34 | 21 | 3 | 0.1299 |
| A signed informed consent prior to fibrinolysis is necessary in the in-hospital setting | 26 | 8 | 42 | 42 | 8 | 57 | 16 | 35 | 42 | 7 | 84 | 27 | 54 | 18 | 1 | 80 | 38 | 40 | 21 | 1 | <0.0001 |
| **Medical Overview and Team Relations** | | | | | | | | | | | | | | | | | | | | | |
| There is currently an effective communication and collaborative working relationship between emergency room nurses, ALS paramedics, emergency room physicians and cardiologists in the care of STEMI patients | 25 | 4 | 76 | 12 | 8 | 54 | 15 | 59 | 24 | 2 | 89 | 16 | 61 | 20 | 3 | 82 | 19 | 66 | 15 | 0 | 0.3709 |
| Familiarity of the Emergency medical Services (EMS) community is an essential aspect for the physician responsible for manning the pre-hospital STEMI response line and providing remote paramedic overview | 26 | 23 | 73 | 4 | 0 | 57 | 40 | 56 | 4 | 0 | 88 | 67 | 32 | 1 | 0 | 82 | 49 | 47 | 4 | 0 | 0.0782 |
| Paramedics can diagnose and treat STEMI patients including fibrinolysis without physician overview | 24 | 0 | 0 | 50 | 50 | 56 | 0 | 2 | 48 | 50 | 88 | 2 | 22 | 59 | 17 | 81 | 0 | 5 | 41 | 54 | <0.0001 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ownership and Responsibility** | | | | | | | | | | | | | | | | | | | | | |
| The physician responsible for remote pre-hospital ECG interpretation and paramedic overview for STEMI treatment should be a cardiologist | 26 | 19 | 31 | 38 | 12 | 57 | 5 | 25 | 66 | 4 | 88 | 17 | 42 | 40 | 1 | 82 | 24 | 38 | 34 | 4 | 0.0006 |
| The physician responsible for remote-pre-hospital ECG interpretation and overview for STEMI treatment should be an emergency room physician | 26 | 0 | 42 | 58 | 0 | 57 | 5 | 47 | 47 | 0 | 87 | 17 | 55 | 28 | 0 | 79 | 20 | 48 | 28 | 4 | 0.0024 |
| All pre-hospital diagnosed STEMI patients requiring urgent cardiac catheterization (i.e. PCI) should first be assessed and triaged in the Emergency Department | 26 | 0 | 27 | 61 | 12 | 54 | 6 | 48 | 44 | 2 | 88 | 4 | 14 | 61 | 20 | 82 | 12 | 26 | 36 | 26 | <0.0001 |
| A quality of assurance program that tracks and reports *time-to-treatment* of STEMI patients is an important means to improve future patient care | 26 | 73 | 27 | 0 | 0 | 57 | 56 | 44 | 0 | 0 | 89 | 53 | 47 | 0 | 0 | 82 | 61 | 38 | 1 | 0 | 0.4661 |
| **Practical Aspects of PHM** | | | | | | | | | | | | | | | | | | | | | |
| Pre-hospital fibrinolysis decreases crowding in the Emergency Room | 24 | 0 | 25 | 75 | 0 | 56 | 0 | 7 | 61 | 32 | 93 | 7 | 25 | 48 | 20 | 82 | 1 | 12 | 50 | 37 | 0.0002 |
| **Technology** | | | | | | | | | | | | | | | | | | | | | |
| I am confident in the current technology to transmit pre-hospital ECGs for remote physician interpretation | 25 | 24 | 60 | 16 | 0 | 93 | 6 | 75 | 19 | 0 | 96 | 12 | 58 | 25 | 5 | 79 | 13 | 64 | 17 | 6 | 0.2379 |
| **Knowledge of PHM process** | | | | | | | | | | | | | | | | | | | | | |
| There is adequate evidence to support the safety and efficacy of pre-hospital fibrinolysis | 25 | 15 | 77 | 8 | 0 | 50 | 6 | 74 | 20 | 0 | 82 | 31 | 64 | 5 | 0 | 74 | 8 | 72 | 19 | 1 | 0.0010 |
| Current literature provides clear guidelines on appropriate approaches to STEMI treatment | 25 | 17 | 57 | 26 | 0 | 56 | 17 | 69 | 14 | 0 | 85 | 39 | 58 | 3 | 0 | 76 | 27 | 61 | 12 | 0 | 0.3634 |
| I am confident in my knowledge of the existing regional pre-hospital STEMI treatment protocol | 25 | 12 | 56 | 24 | 8 | 56 | 2 | 57 | 41 | 0 | 86 | 31 | 63 | 6 | 0 | 77 | 3 | 67 | 29 | 1 | <0.0001 |
| **Training and Maintenance of Competence** | | | | | | | | | | | | | | | | | | | | | |
| Formal intermittent reviews of the regional pre-hospital STEMI treatment protocol are key to the program's success | 25 | 68 | 32 | 0 | 0 | 57 | 53 | 45 | 2 | 0 | 88 | 43 | 55 | 2 | 0 | 80 | 61 | 39 | 0 | 0 | 0.7277 |

* p-values are calculated on combined SA/A and D/SD using the chi-squared and fisher's exact test.

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# Chapter 4

# Conclusion

## 4.1.0 Discussion

In patients with STEMI, maximal benefit of reperfusion therapy is achieved when treatment is delivered in the shortest duration from symptom onset.[1] Rapid reperfusion is consummated with pre-hospital management and fibrinolysis (PHM).[2] Despite the accumulating clinical trials evidence demonstrating the feasibility and benefits of PHM, widespread implementation of PHM programs in healthcare regions across the nation has not occurred.[3]

Identifying barriers and facilitators to a PHM program becomes paramount in improving both existing PHM strategies and enhancing implementation of new PHM programs. Clinical trials, though effective in demonstrating the feasibility and efficacy of administering fibrinolysis in the field,[4] fall short of identifying underlying and unexplored factors influencing PHM integration into healthcare systems. Under this circumstance, qualitative research methods are invaluable tools to identify key issues regarding PHM by capturing views of stakeholders of the program. However, previous studies using qualitative research for this purpose have been conducted within the European healthcare setting, and have examined the views of paramedics exclusively.[5,6]

Against this background, we determined a need to consult the views of all stakeholders (paramedics, cardiologists, emergency physicians and emergency nurses) in direct care of STEMI, rationalizing a potential to maximize the number of unexplored barriers and facilitators that can be identified by capturing views from diverse perspectives. In addition, by involving all groups we hope to enhance a unified sense of

ownership and teamwork over the care of STEMI patients. Accordingly, we employed the use of focus group methodology to extract issues from stakeholders, and sought further insights into the external validity of the results by subsequent administration of a survey.

Focus group sessions yielded five domains of potential barriers: knowledge of PHM process and protocol, practical aspects of PHM, ownership and taking responsibility of patient, capability and interest of paramedic to provide PHM and technological assistance. Six additional domains of potential facilitators were also identified: knowledge of PHM process and protocol, practical aspects of PHM, ownership and taking responsibility of patient, capability and interest of paramedic to provide PHM and technological assistance. The twelfth theme, that of informed consent contained complex discussion and warranted an independent analysis. The 11 themes relating to "Barriers of PHM" and "Facilitators to PHM" were comprised of sub-themes, each derived directly from participants' quotes, which totaled 47. Unique to our study, a further step was taken to quantify qualitative data with the intention to compare the magnitude of importance that each group placed on all 47 issues. This system allowed us to observe issues that emerged uniquely in certain groups, or ubiquitously across all groups, while still enabling us to root the sub-themes to the original data, thereby preserving the context and content.

Content from the focus group, with additional to input from investigators familiar with PHM, served to create a survey that was distributed to stakeholders within the Edmonton healthcare region. Using focus groups to generate items for survey development is methodologically desirable as it holds a high degree of content validity.[7]

While perceptions of most of the issues collected from the survey were largely comparable to the focus group-derived views, others were strikingly contradictory. In addition, the questionnaire demonstrated the magnitude of responses of all groups on an issue, including those that were specifically raised by three groups or less in the focus groups. As a result, the surveys tested the external validity within a group, as well as across all groups.

### 4.1.1 Implications

Results from our project have strong implications in improving existing PHM programs and implementing new programs around the nation. Implications stem from both the study methodology and the identified issues.

4.1.1.a Implications of Study Methodology

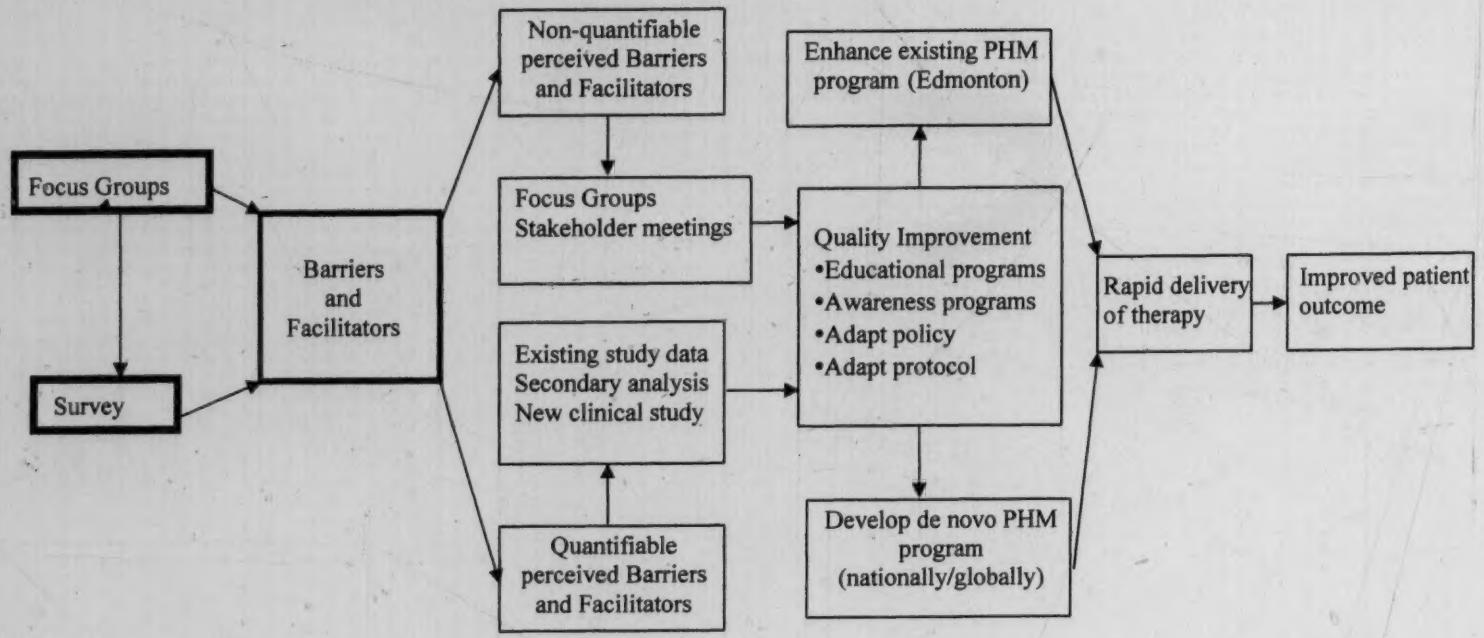
We used both focus group methodology and a questionnaire survey to collect and quantify opinions from all stakeholder groups presenting perceived barriers and facilitators. Our approach helped identify barriers and facilitators in the arena of PHM implementation within North America which may not have been possible if surveys had been used exclusively. Consequently, other healthcare regions intending to implement a PHM program can use this combined focus group/survey method to identify underlying barriers and facilitators in their region.

Furthermore, healthcare regions planning to implement a PHM program with a similar concept to ours and the ACC/AHA guidelines[8] can use our survey instrument or a modified version to assess stakeholder perceptions. The survey can also be applied in the initial stages and downstream stages of the program to determine level of stakeholder buy-in, and changes in perceived barriers and facilitators following interventions.

4.1.1.b Implications of Identifying Barriers and Facilitators

The final stage of our study produced a variety of identified barriers and facilitators from the focus groups, of which a portion that were deemed to be of higher priority were externally validated. The implications of identified issues described below are summarized in Figure 4-1.

Figure 4-1: Implication of Identified Barriers and Facilitators of PHM



The next step is to distinguish the perceived issues that can be supported quantitatively from ones that cannot be. Issues that cannot be confirmed quantitatively can be further analyzed through subsequent focus groups, or discussed at stakeholder staff meetings.

Issues that can be quantified as variables or measured can be confirmed by reviewing existing registry or clinical trial data, conducting a secondary analysis of a study, or by conducting a new study. Confirmation of perceived concerns can be applied to regions intending to improve an existing PHM program such ours, or implement a new PHM program.

Perceived barriers can be confirmed or refuted as actual phenomena by reviewing current literature. For example, data from survey demonstrated that 30% of paramedics and 16-23% of hospital staff did not have confidence in the ability the pre-hospital ECG technology to transmit data for remote physician interpretation. Participants, primarily the paramedics, from the focus group explained that this perception may deter some paramedics from providing PHM. However, statistics from a recent Canadian study demonstrated a 6% failure in ECG transmission.[9]

Secondary analysis of an existing survey can also verify the reality of perceived issues. As an example, the survey demonstrated that a minority of CARDS 48% and EP 45%, and a moderate majority of PARA 67% (RN 77%) felt that pre-hospital 12-lead ECG and identification of STEMI reduces in-hospital *time-to-treatment* to a similar degree as pre-hospital fibrinolysis (PHF). In contrast to the CARD and EP view, one study showed that pre-hospital diagnosis of STEMI patients with direct transfer to PCI

reduced time-to-treatment by 1 hour compared to in-hospital diagnosis.[9] This saving in time-to-treatment is similar to PHM STEMI patients versus in-hospital treated patients.[9]

When data or studies providing insight on quantitative properties of issues do not exist, a new study can be conducted to confirm the reality of perceived concerns. For example, our survey reported that more than half of hospital staff members, and a quarter of paramedics felt that urban paramedics are better equipped and trained than rural paramedics to assess and treat pre-hospital STEMI patients. Whereas an inventory and comparison of equipment can confirm the former view, a new study comparing the knowledge of rural paramedics versus urban paramedics on PHM can be conducted.

*4.1.1.b.I Rectifying Confirmed Barriers, Facilitators and Misconceptions.*

Once factors influencing PHM implementation are confirmed, they can be addressed through changes in PHM policy and protocol, and educational programs to stakeholders groups. Hypothetically, emergent misconceptions can be abated through the creation and circulation of newsletters to respective stakeholder groups, and through respective educational programs. In conditions where such newsletters exist, as is the case with the regional paramedics, content can be provided by the PHM program's steering committee. Stakeholder educational programs can be utilized as a means of informing individuals of barriers and facilitators to PHM, while conveying strategies to address factors for effective PHM delivery and patient care. These means of communicating knowledge of factors influencing the program would also ensure a unified understanding of the PHM process amongst all stakeholder groups. Retention of knowledge on PHM by all stakeholders is also critical to PHM operations, and frequent

use of educational programs and newsletters to convey PHM-related matters will also serve this purpose.

In addition to newsletters and education programs, changes to key areas of the PHM policy to enhance PHM delivery and implementation are conceivable. For example, paramedics in the focus group, and a large majority of all stakeholders accepted that physicians in charge of remote ECG interpretation and overview must be familiar with the EMS community and their field experiences. This suggestion, if deemed reasonable by the PHM steering committee, can be accomplished by requiring physicians in that capacity to participate in a defined number of ambulance "ride-alongs".

*4.1.1.b.II Implication on STEMI Patient Outcome*

The most important implication of or study is that by enabling researchers to confirm and address identified barriers and facilitators, time to treatment can be reduced. In addition, addressing barriers and facilitators can enhance implementation of a PHM program nationally and internationally. Collectively, enhanced use of PHM will facilitate rapid therapy delivery and maximize chances for improve patient outcomes.

**4.1.2 Future directions**

With perceptions of a PHM program acquired from stakeholders in direct care of STEMI patients, the next step could involve assessing the views of STEMI patients. Independent focus groups and survey studies can be conducted on two STEMI patient populations (self-presenting MI patients and MI patients transported by ambulance) to explore important issues relating to PHM.

Self-presenting patients may provide insight on why they opted to transport themselves, in lieu of ambulance transportation with the capacity to provide early

diagnosis and treatment. Knowledge from this group can be used to address the barriers to taking an ambulance through educational programs or changes in policy to reduce symptom-to-treatment, thereby improving clinical outcomes.

MI patients transported by an ambulance may also provide valuable information regarding various aspects of PHM such as: the informed consent process, quality of service paramedic service, quality of care from pre-hospital to in-hospital care and confidence in the program. Information collected from this group can go towards improving an existing PHM program through changes in both PHM policy, patient care policy, and education programs to paramedics, hospital staff, and patients at risk of an MI.

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## APPENDIX 1

**Themes and Sub-themes with Respective Sample Phrases from Participants**

**Themes and Sub-themes with Respective Sample Phrases from Participants**

Below are selected quotes to provide examples of themes identified in Table 2-2. Continuous discussions are enclosed inclusively in quotation marks (" "). Investigators comments have been added in <comment> if required for clarity.

**Barriers to PHM**

**1. Knowledge of PHM process and protocol**

**a. Lack of knowledge (or uncertainty) on aspects of the PHM protocol**

*"So they are supposed to go to the cath lab to see if they reperfuse? EP*
*No. EP*
*No they wont. EP*
*No , they either go to the cath lab.. oh wait..oh I don't know.. EP*
*I mean, the plan is that they are supposed to go the cath lab. EP*
*Yeah, but they will stop at emerg? EP*
*With this program, are they all going to one centre or are they going to different centres? EP*
*Will they go to the emerg though? EP"*

*We don't know any of the criteria for VHR, we don't understand how VHR works. RN*

*Give paramedics a specified/simplified protocol – pre-loaded syringes. If X situation, give blue marked syringe, if Y situation give red marked syringe CARD***

**<TNK-tPA is a powder that requires – reconstitution with a dilutant, making pre-loaded syringes impractical>.

**b. Perception that focus on PHM will be robbing from trauma**

*Because, I mean, we're looking at, looking at, a cardiac, and everything we have, we set up these systems, but we never look at the sys – "o.k. this is what cardiac is doing, but its impact on the other systems (uhm hmm, yeah)..., are we putting too much emphasis on this and robbing from trauma? And..I mean.. that's probably a poor example. EP*

**c. Perception that some hospital staff are unaware of PHM protocol**

*the only problems I ever had in ASSENT 3+ study was with hospital staff who were not trained to the study, and that was one of the thing that, EMS staff were trained, some of the docs some of the nurses were...So then, uh...not confusion or angry, but almost a frustration on the nursing staff's part, because they didn't know it was coming, they uhm, and then they also, I mean, it's a professional thing, right. They wanna be able to know as much as the paramedics do, and they almost feel slighted that: well they [paramedics] are doing more than we are, they [paramedics] know more than we do. PARA*

*And again feeling that they weren't part of that system PARA*

**d. Incongruency in literature or understanding of literature on MI therapy**

*...there's people [paramedics] who believe because there's a certain studies... they would show maybe..., PCI was more effective than thrombolytics, in certain situations, uh, we did run into where people, and again, I don't know how much sort of information, or where they're getting their information from, where (...old information), yeah exactly, it maybe old information, or maybe, you know, in certain situations yes PCI will have the, sort of, better outcome, when it comes to morbidity and mortality. But, uh, just really, reluctant about it. Basically, almost to the point of saying "I will not give a thrombolytic to the patient, I will not" PARA*

**e. Lack of knowledge of paramedic team protocols**

*"Its still our same paramedic crews as two right? EP*
*But they often call in a second crew for things like this... EP*
*They will – EP*
*If they can, yeah, get a supervisor or a second crew –correct me if I'm wrong but EP*
*Yeah, maybe not for – Not always, not always EP*
*But I think if they need an extra pair of hands ( Sure, Yeah ) EP"*

**2. Practical aspects of PHM**

**a. Perception that PHM will have no effect and/or will increase overcrowding in Emergency department**

*So that might potentially uhh.. increase overcrowding in the two centres, because if before the study..before VH, if they would go to the closest hospital, because all hospitals can manage STEMI with...with..ah fibrinolysis, but if because of this they are going directly to the two centres that's going to overcrowd those two...especially if there's going to be a heart institute at this centre, everyone is going to want to come here because the public perception will be 'oh the heart institute is here, therefore I want to go to the heart institute" EP*

*Having to make a space for a patient – that's a stress RN*

**b. Perception that MI patients will avoid taking EMS due to cost**

*It's a, its an attitude and generational thing though – I mean, people go to the hospital, first of all they know they're gonna get a bill for the ambulance, they don't want that. Second of all, the hospital is a sanctuary where, once you get in there, you're safe. Uh, they, they're reluctant to call because they don't want to wait. " I can drive a hundred miles an hour and be at the hospital" PARA*

**c. Perception that Patients with MI will avoid going to the hospital due to wait times**

*And one of the other things you hear too is, not only once you're in the hospital, but you gotta get out of the wait room. And everybody knows, because of all the media, about the wait times...Having to sit there for six hours and not do anything, "so why go anyway?" And, by the time we get called, four hours later, I mean its, you know, huge problems. PARA*

**d. Perception of lack of communication between paramedic and hospital**

*Typically sometimes what happens is, you get to emerg and somebody didn't contact somebody (yeah), and then you're sitting there going "well I have this patient that's enrolled in this study, or, that I've, is Vital Heart [STEMI patient]" and they're [hospital staff] going " mmm, we don't know anything about him" PARA*

**3. Ownership and taking responsibility of patient**

**a. Negative perceptions about steps in the protocol (i.e. PHM diagnosed patient stopping at the emergency department for triage)**

*"Yeah, I mean system wise there shouldn't be a stop at emergency, that's an extra link, and I don't understand why we would do something like that if we're just looking at it from a system point. EP*
*But a Cardiologist can handle an unstable STEMI patient up in the CCU. So even if they're unstable, why should they have to stop with us? EP"*

**b. Perceptions on ownership of and taking responsibility of patient**

*One thing about those other studies was that I always felt "why is a cardiologist reading this for me?" o.k. I've been making decisions on thrombolytics for years. Why wasn't it being faxed for me? And it seems as a poor use of a cardiologists, o.k. to sit on call for that type of thing... EP*

**4. Capability and interest of paramedic to provide PHM**

**a. Skepticism (lack of trust) in some Paramedic to carry out PHM effectively**

*Because often what we see in emerg, I'm not saying from cardiology, but from the vast spectrum of our specialist colleagues is that the opinion of outside uhm..sources is not always trusted or the state of the patient as relayed to them by consult or phone is not always trusted. EP*

*I think drug errors always more common in a panic situation and small room and that kind of thing. EP*

*"...there's no doubt there's people [paramedics] out there that are intimidated (yeah, DK), They are intimidated maybe simply by doing the 12-lead (Yes), by interpreting the 12-lead, cause there's lots of guys out there that still don't know how to interpret the 12 lead. They are very intimidated by having to give a thrombolytic. And there, I mean, there's no doubt in my mind, there's going to be those guys that look at that guy and go "I'm fifteen minutes from the U –I aint doin' this, I'm going" I mean, we all know that there is a certain percentage of people that will do that. PARA*

**b. Perception that some paramedics in rural areas are not capable of effectively providing PHM**

*"Paramedic services in the rural areas, like from a 100 miles out, may not be strong in identifying STEMI. RN*
*It might not be appropriate for them to carry out PHF. Their learning curve is greater. RN*
*It also comes down to how much they get paid.*
*The ones in the rural areas get paid half as much, so their quality of training and capability of providing care isn't as good. RN"*

**c. Perception of paramedic misdiagnosis**

*Yeah, I think every time I thought it was an MI they thought – (they over call ) they'll overcall. – think its a left bundle... or it's a bit of whatever, and they'll call it an MI. EP*

*Paramedic may also be "missing pieces of a picture" while diagnosing and treating patients. RN*

**d. Perception that paramedics' inability to handle complications (or situations outside of protocol) will cause problems.**

*And if you imagine...complications are going to be around too, so if they do bleed or something then, then it leaves that... sort of this protocol and it gets into complications of bleeding and medications (yeah) and that kind of thing which might then rely more on your skill (yeah). EP*

**e. Perception that some physicians maybe resistant to PHM**

*I think you would still find the occasional emerg doc who doesn't think the paramedic should to be thrombolysing EP*

**f. Perception that some paramedic will be disappointed by VHR physicians' decisions.**

*"... some of us would, you know when we first started this [PHM], myself included, you need to be reluctant to call because you think "well, you know, am I bugging them because this maybe something that isn't clear? Or, you know, am I doing something and he's going to say no? (yeah) right, and sometimes he has excluded though (yeah). They*

*have exclude patients –is to emphasize to your staff, not to take that as a slight (yeah), but to make sure they're doing things for the safety of the patient- PARA*
*When people want to "you know, I called them and he [physician providing overview] didn't let me do that" right PARA -and they[paramedic] take it as a negative PARA"*

**5. Technological Assistance**

**a. Perception of technological failures inhibiting ability to mange patient**

*quality of ECG – may not be good, or bad transmission CARD*

*You bring up a good point, I mean, I've, I've had seen crews where they twice to fax and it didn't work, and its like "screw this" PARA*

*I've been involved in two patients who were in this vital heart response, well... one the fax machine didn't work, so the paramedics correctly identified STEMI and tried to fax it to the doc and the fax machine didn't work so I got the call from the docs saying " well, I can't see the fax... EP*

**b. Knowledge of technical problems as a barrier to PHM**

*"You know, it's the, two problems with technology, right. It's the user and the equipment. PARA*
*And you'll get some users that, just, plain can't do it. For lack of, you know they haven't bothered practicing, they haven't bother really paying attention when we're doing the training...PARA*
*And of course in our situation, if you're in some remote areas, you may not have cell coverage (yeah, right), so they have to go till they get that. PARA"*

**<u>Facilitators of PHM</u>**

**1. Benefits of PHM**

**a. Knowledge that access of expertise is brought to patients with PHM**

*Again it's just moving the expertise to the patient..,EP*

*I think obviously, we reduce door-to-drug time because we see them [STEMI patients] before[reaching the hospital]. PARA*

**b. Perception that PHM may increase the flow of in-hospital patient treatment**

*But the other thing too, that might happen is that once they go to the cath lab they can't recover in emerg they have to go to Ccu (they're not supposed to..yeah...). So it might actually relieve the back end. EP*

**c. Perception that PHM will decrease in-hospital workload**

*Yeah there would be a decrease in work load – you know when we thrombolyse a patient (its a lot of work) we mobilize on a lot of nurses –there's like three or four nurses there (that is true) getting the lines in, so, I think there is a work load transfer. EP*

**d. Perception that PHM may increase the number of people talking ambulances during a heart attack with public awareness programs**

*"I think, as the Vital, Vital Heart, as the advertisements gets out there, I there will be more people that start to do it (yeah, they might do it). Some of them appropriate some them inappropriate. EP*
*Like the "brain attack" campaign adds I think work quite well... people understand slowly, I mean slowly, people – population will still be in denial all the time. EP"*

*public awareness – public blitz – may increase number of people taking ambulance. CARD*

**e. Perception that PHM process will benefit patients even if there are contraindications to drug use**

*I had a crew, I think it was last week, identified a patient –was contraindicated for fibrinolysis –still contacted the physician and got pushed directly to the angio lab. So, we're decreasing that time significantly compared to if they had been just going to a hospital and then through, sort of, normal channels –the in-hospital channels PARA*

*Benefits of PH treatment even without fibrinolysis exists: you can prep a cath lab early. CARD*

**f. Perception that PHM will decrease cost to healthcare system**

*Less time in rehabilitation or long term care, therefore ease on the healthcare system. RN*

*Money, I mean... if we can decrease the amount damage done to the heart by decrease that, door-to-drug time, then we're saving long term costs in terms of rehab, you know, we can prevent somebody from needing to go to angio, ...you prevent, even a days stay in the CCU...big money [saved] for the healthcare system overall... PARA*

**g. Knowledge of clinical benefit (including reducing time to treatment)**

*Well...the obvious one is patency, early patency of the artery and all the good results that come from that. EP*

*"Time is muscle" RN*

*We all know that "time is people's muscle"... PARA*

*...but even in the Emerg rooms it takes a half an hour or longer to lyse [fibrinolyse] an MI patient – so even in the city, it may be useful. CARD*

**2. Medical overview and team relations**

**a. Integrating key players to form a team approach (accepting paramedic as 'equals') or (understanding the importance of a good physician-paramedic relationship)**

*...it's the team approach which is coming in medicine, has come in medicine, which will continue ..and I think its using the team players to their maximum and the paramedic have the ability to do this, lets use their talent. EP*

*I think one of the things that, that I have seen over the years is, when you have a good paramedic physician relationship –that oversight...The end result is, I see the patient getting a better... care at the end of it... So, when you have someone who understands EMS, who respects us for what we do, the patient is the winner. Absolute winner in all that. PARA*

**b. Perception that medical overview is needed to ensure effective treatment of patient in the field**

*"I think there needs to be a doctor. EP*
*There has be to oversight. EP"*

*That's one thing too that so important is the physician and the medical director of the cardiology, uh, interface has to be there. I don't think you're ever gonna see a time where you have the paramedics purely making those decisions on their own. Uhm, they always say that its easier to, uh, take that manure pile and spread it as thin as you can and, hand it to as many people as you can, and when you involve more physicians, or other personnel is gets a little a easier, to say " I'm going to give a very potentially danger drug to somebody I think is having an MI from what my clinical interpretation is. PARA*

*[with regards to paramedics doing PHM independent of medical overview]: not yet... may need more training, but definitely not now. CARD*

*There are too many mitigating circumstances, too many external events that can create havoc or complications. So they can't do it all alone. RN*

**d. Perception of sound communication between paramedic and hospital**

**c. Perception that paramedic may have better access to cardiologists than emergency physicians**

*"We have better access to these experts than do the average emergency room doctor. PARA*
*Yeah, yeah. And typically, they will be the ones that will be calling –trying to get a hold of somebody in cardiology for a consult. And, and we have better access than they do – often, they will phone them and wait for somebody to call them back. PARA"*

*In the ASSENT and the WEST I've personally haven't had any trouble. Anytime that I've presented to the hospital, they know we're coming and you know, whoever I've spoken to on the phone will usually, you know, they just say "what hospital are you going to?" and that and its always been seamless. PARA*

**e. Perception that rural paramedics have a closer relationship than urban paramedics with respective hospital**

*"And I think, traditionally too, I mean, rural hospitals and rural ambulance services you have a much closer relationship with your hospital too. PARA*
*I mean, I know when I was at Leduc, we were involved in education with them, we were involved in this, you know, we used to go over and help out all the time, where you don't have that opportunity in the city. PARA"*

**3. Practical aspects PHM process and protocol**

**a. Knowledge of some EMS protocols**
*...they[EMS] have those protocols that, those questions that they go down different paths, so you get a chest pain and then you start asking questions and according to that. EP*

**b. Perception that a simplified protocol for the stakeholders will facilitate PHM**

*Cardiologists, emerg docs and physicians need a clear one page or so protocol. It would benefit cardiologists to have a simplified step-by-step protocol to know what to do. CARD*

*Bring in a 1 pager or a summarized page of VHR information. RN*

**c. Knowledge of real life field experience or knowledge of source of delays to treatment**

*Well, and I think you have to get over the fact that its not that you're fifteen minutes from the U, you're fifteen minutes physically from the U (yeah), but then you've got all those hospital delays (exactly), and which is why we want to do pre-hospital (exactly). PARA*

**d. Perception that placing cardiologists at peripheral sites will facilitate PHM**

*There should be dedicated cardiologists in the peripheral areas RN*

*One of my Concerns about that is then, uhm, its concentrating specialties again in the central areas, and whereas we need to keep –maintain a certain work base for our specialist in the Mis. If we're starting to take that work load away from that hospital and over there, put it the university here and the Alex [Royal Alexandra Hospital] , then there's a critical volume of work that they need, that's a risk to uh.. other than the tertiary care hospital. EP*

**e. Perception that setting benchmark times for steps in the protocol is needed**

*Issue is...to deal with on going quality control: set standards. For example, set standard times for how long it should take to get ECG. If takes long, then no point in PHF, just go to emerg [emergency department]. CARD*

*Need to establish benchmark times to successful ECG transmission CARD*

**f. Consistency of STEMI patient management protocol**

*In our particular situation, they have a checklist much the same as we do (yup), and the nurse starts at that and the doc does that –and he typically he'll go to the phone and phone for a consult. PARA*

**4. Training and regular maintenance of competency**

**a. Perception that continuous training (to maintain skills) by paramedic will facilitate PHM**

*Different aspects would need to be maintained more than others ( i.e. paramedics do more IVs than ECGs). CARD*

*yeah so as long as you have consistent training with ... I guess its called continuing training, because, you know, it's a new program and everyone is hot for it, if you don't pick up a STEMI [patient] in a year, you know its all just going to be gone, so your skills will be gone...right. EP*

*I think it should be good as long as they are frequently reminded of the protocol and how to manage STEMI. RN*

*The second problem, is people problems. Is how you get people do it, and make sure they do it right. And it comes down to QI –you catch people who might not be doing a good job, you let them know. Comes down to ongoing training. Best thing we ever did in Edmonton was [unclear] Project. Uhm, that's still probably the best...training that I ever received to give lytics in the city. Without a doubt, hands down. That was such a beneficial thing. PARA*

**b. Perception that simulations may complement real life exposure to MI cases to maintain competency**

*"...but they [paramedics] can still do training (yeah) like not just give the lytic ...go through the... protocol recognition, the whole... they can go through the kit (yeah that's true) they can do training every six months or something...EP xx*
*Well, like [EP xx] said, you could do the simulations stuff. EP"*

*"My question is, if you said three a year [performing PHM], could one of those or two outa the three be simulations? PARA*
*I guess I would say yes, if the simulation was complete. PARA"*

**c. Perception that increasing the quality of paramedic education program is needed to promote confidence**

*I mean, and I think a lot of it is, is intimidation, its exposure (I agree), it, its like when you first learn to read ECGs, right, if you didn't –like I always tell people "I don't care if you're wrong 99 times, the 100th time you'll be right and eventually get it." But I think what happens is a lot of times, because that's how it was done, you just printed off a 12-lead and you didn't' care what it said you handed it to the nurse or the doctor. And some people just never got out of that mindset and honestly think part of is educ-, lack of education, I don't think we've truly done a good job of that yet. And uhm, so I think there's lots of people that would, be, rather handed off to the family member to read (laughter), rather than trying to read it themselves. PARA*

**d. Knowledge that one must be critical of results published in the literature**

*But I mean, that is one of the big criteria [of choosing reperfusion approach], like when they look at, when the new information came out as to really which guys are, are better of getting thrombolytics versus the cath lab, that has changed significantly than a few years ago. PARA*

**5. Paramedics' willingness and capability of managing acute MI patients**

**a. Paramedics are capable of providing pre-hospital care to acute MI patients**

*"I think they are... EP*
*I do, they have been for awhile. EP"*

*When it comes to advanced Cardiac Life support, Paramedics are experts at that...most of what we do, regarding patients with MI, acute myocardial Infarction, everyday we do stuff like that. PARA*

*ECG competency may already be maintained, because they have to know it well and use it for all chest pains. CARD*

*"Yes, they see more of those patients than we do. RN*
*They have ACLS. RN"*

**b. Paramedic's ability to handle bleeding (complications)**

*...its still like two people, maybe four people at the back of a box, like its still...you know... difficult. But yeah, I think they can. EP*

*Reperfusion arrhythmias or V-fib can be handled by paramedic. CARD*

**c. Paramedic will find added responsibility of providing PHM professionally rewarding**

*Now with identifying patients and...CPR or giving the drugs in the field, and it makes a huge difference to patient care. And that's rewarding, cause I think all of us are here to help people as best we can...PARA*

*Paramedics would appreciate extra responsibility. CARD*

**d. Knowledge that PHF is protocol driven and perception that STEMI is not too difficult to treat.**

*... yeah cause, you know STEMI is a pretty...straight forward thing... EP*

*I think the difference is that it is protocol driven, so, it doesn't rely as much on the differing experience and "have you ever seen this before?" Its going to be a "this case, this case, this history (right right), this ECG, this" – you know, " are the vitals between this and this-" its much more protocol driven... EP*

*Oh, I was just going to say they, the protocol now, the Vital Heart is relatively easy ... You have a lot of times, you walk in the door you don't, I don't need an ECG to look at somebody and say "they're having the big one". The typical. PARA*

**6. Technological assistance**

**a. Perception that technology is a positive factor in PHM**

*I was just going to say, those thing, and, and, perhaps maybe in the future Capital Health or the Vital Heart, as this grows can, have some influence on whoever supplies money or that technology to improve its future too... PARA*

**b. Confidence in the ECG technology and transmission**

*And we've had some excellent cases in the city where, they started, they did the serial 12 leads and the MI showed up (yeah), and, uhm, I mean I've tried to use them in most of my education courses so they could see "hey, this was an actual crew here, see the importance of it." Like within 10 minutes (yeah yeah, ten minutes) the, the, ST elevation –it was a crew going to St. Albert, and it was an Atypical guy and why they did the serial 12 lead, I don't know, but it was excellent. PARA*
*"ECG quality is generally good. CARD*
*Even though baselines are sometimes off, it's workable. CARD"*

**Informed Consent**

Paramedics (PARA)

*"Well, it [PHM informed consent] should be the same as the hospital.*

*The shortest possible-*

*Whatever parallel they do in [the hospital] - cause the question may come up why, I don't know if it'd come up legally, 'why are you doing something different than the hospital?'*

*Because I have to admit, in the emerg department, I've never done a consent for treatment on a thrombolytic.*

*Here's another question too. When we go to anyone else's home for any other problem, do we ask them to sign consent?*

*But I don't know if I've done an actual, like, since they intro- since they started vital heart. I mean, I know with any, before that, any thrombolytic, I mean, it was just a verb- you know ( a verbal consent), the physician says "I'm gonna give you this," (implied consent ).*

*And I don't know, it may have been something new, just, because its new to us right, like it's a new thing –.*

*Who knows, it could've been driven by our management. That's a liability risk management from their point."*

Cardiologists (CARD)

*"Do other procedures (broken leg) need informed consent? Why this?*

*If informed consent is mandatory, it needs to be very short, 1 page at the most.*

*EMS have requested it, thus, an unavoidable delay."*

Emergency Department Physicians (EP)

*"I think it's [informed consent] a waste –*

*How many patients can make an informed consent about an MI?*

*I don't get signed consent when I lyse somebody in the department.*

*And I don't think patients in the middle of an acute MI in the back of the ambulance can give*
*informed anything. I think they're sick and scared.*

*And they'll... do what you say.*

*Yup, and you can sell it either way.*

*You could give this "terrible drug, and might make you bleed, or "we're gonna save your life" you know, one of the two."*

Emergency Department Nurses (RN)

*"But for drugs like fibrinolytics, there should be a signed consent.*

*I can understand for a study, but if it is standard of care, you shouldn't need one.*

*Like they don't for TPA for strokes because it's standard of care.*

*I think you have to for that as well.*

*I say if it's standard of care, you don't need to have it signed. But if it is a study, you do."*

# APPENDIX 2

## Questionnaire-Survey Instrument

## Pre-hospital Paramedical Management of STEMI: Interrogation of attitudes, knowledge and capabilities of paramedic pre-hospital assessment, diagnosis, triage and treatment of ST elevation acute myocardial infarction patients

### Demographics

*Please tell us about yourself. Mark the checkbox next to your answer.*

**Specialty**

☐ Cardiologist ☐ Emergency Physician ☐ Paramedic ☐ Emergency Nurse

**If Physician or Nurse**, please indicate current hospital work site *(check all that apply)*

☐ Grey Nuns ☐ Royal Alexandra ☐ Leduc ☐ Misericordia
☐ Sturgeon ☐ University of Alberta

**If Paramedic**, please indicate current work region *(check all that apply)*

☐ Edmonton ☐ Parkland ☐ St. Albert ☐ Strathcona
☐ Leduc

**If Paramedic**, please indicate level of training achieved ☐ BLS ☐ ALS

**Years of work experience** ☐ Less than 5 years ☐ 5-10 years ☐ 11-15 years ☐ 15+ years

**Gender** ☐ Male ☐ Female

### Survey Questions

**Instructions:** *Read the following statements carefully and mark only one response per statement that best reflects your opinion.*

1. Pre-hospital fibrinolysis decreases patient morbidity (e.g. congestive heart failure)

   ☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

2. Pre-hospital fibrinolysis reduces *symptom-to-treatment* time in rural areas.

   ☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

3. Advanced Life Support (ALS) paramedics are capable of obtaining a 12-lead ECG in the pre-hospital setting.

   ☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

4. A signed informed consent prior to fibrinolysis is necessary in the pre-hospital setting.

   ☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

5. There is currently an effective communication and collaborative working relationship between emergency room nurses, ALS paramedics, emergency room physicians and cardiologists in the care of STEMI patients.

   ☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

**Pre-hospital Paramedical Management of STEMI: Interrogation of attitudes, knowledge and capabilities of paramedic pre-hospital assessment, diagnosis, triage and treatment of ST elevation acute myocardial infarction patients**

6. The physician responsible for remote pre-hospital ECG interpretation and paramedic overview for STEMI treatment should be a cardiologist.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

7. Pre-hospital fibrinolysis reduces *symptom-to-treatment* time in urban areas.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

8. There is adequate evidence to support the safety and efficacy of pre-hospital fibrinolysis.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

9. ALS paramedics are capable of safely and accurately administering required medications (i.e. IV anticoagulant and fibrinolysis) to pre-hospital STEMI patients.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

10. Pre-hospital fibrinolysis decreases patient mortality (death).

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

11. Current literature provides clear guidelines on appropriate approaches to STEMI treatment.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

12. In your healthcare region, there are enough myocardial infarction cases a year to warrant pre-hospital fibrinolysis.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

13. A signed informed consent prior to fibrinolysis is necessary in the in-hospital setting.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

14. The physician responsible for remote pre-hospital ECG interpretation and overview for STEMI treatment should be an emergency room physician.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

15. Familiarity of the Emergency Medical Services (EMS) community is an essential aspect for the physician responsible for manning the pre-hospital STEMI response line and providing remote paramedic overview.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

16. Urban paramedics are better equipped and trained than rural paramedics to assess and treat pre-hospital STEMI patients.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

17. Pre-hospital 12-lead ECG and identification of STEMI reduces in-hospital *time-to-treatment* to a similar degree as pre-hospital fibrinolysis.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree


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**Pre-hospital Paramedical Management of STEMI: Interrogation of attitudes, knowledge and capabilities of paramedic pre-hospital assessment, diagnosis, triage and treatment of ST elevation acute myocardial infarction patients**

18. Formal intermittent reviews of the regional pre-hospital STEMI treatment protocol are key to the program's success.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

19. A quality assurance program that tracks and reports *time-to-treatment* of STEMI patients is an important means to improve future patient care.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

20. ALS paramedics are capable of identification of ST elevations and preliminary interpretation of pre-hospital 12-lead ECGs.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

21. Pre-hospital fibrinolysis decreases crowding in the Emergency Room.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

22. All pre-hospital diagnosed STEMI patients requiring urgent cardiac catheterization (i.e. PCI) should first be assessed and triaged in the Emergency Department.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

23. Paramedics can diagnose and treat STEMI patients including fibrinolysis without physician overview.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

24. I am confident in the current technology to transmit pre-hospital ECGs for remote physician interpretation.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

25. I am confident in my knowledge of the existing regional pre-hospital STEMI treatment protocol.

☐ Strongly Agree ☐ Agree ☐ Disagree ☐ Strongly Disagree

Please feel free to add other specific comments: _____

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**Thank you for completing this questionnaire**

*If additional information or clarification of any of these questions is needed, please contact:*

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